EXPLOSIVE GAS MANAGEMENT PLAN

INACTIVE SANITARY LANDFILL

Prepared For:

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CEC Project 191-750

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1.0 INTRODUCTION

The following Explosive Gas Monitoring Plan (EGMP) has been developed for the evaluation of subsurface landfill gas migration at the West Lake Landfill Superfund Site, Operable Unit 2, specifically the Inactive Sanitary Landfill (ISL) sub-unit. This EGMP has been compiled in accordance with Missouri Department of Natural Resources (MDNR) regulations in effect at the time the landfill ceased accepting waste. In addition, the general framework of this EGMP includes items recommended for evaluation of subsurface landfill gas migration established in published U.S. Environmental Protection Agency (EPA) guidance.[1]

The ISL is subject to regulation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Record of Decision (ROD) for Operable Unit 2, including the ISL sub-unit, was issued in July 2008. The requirements for landfill gas migration monitoring and control in 10 CSR 80-3.010(14) (2008) are considered relevant and appropriate requirements as set forth in the ROD, and therefore serve as the primary regulatory basis for this EGMP. These regulations are provided in Appendix A in addition to landfill gas sampling guidance published by the MDNR.

A general Site location map is illustrated on Figure 1. Operable Unit 2 is divided generally into three specific disposal sub-units. These include:

- Closed Demolition Landfill (CDL);
- Former Active Sanitary Landfill (a.k.a. Bridgeton Landfill); and,
- Inactive Sanitary Landfill (ISL).

ISL limits are illustrated on Figure 2 and are the focus of the EGMP. A general diagram of the entire site and spatial relationship of each sub-unit is illustrated on Figure 3-5, which was obtained from remedial investigation reports associated with other portions of the Site[2]. Each sub-unit is

[1] Guidance for Evaluating Landfill Gas Emissions from Closed or Abandoned Facilities, EPA-600/R-05/123a, September 2005.
[2] Remedial Investigation Addendum, West Lake Landfill Operable Unit 1, Engineering Management Support, Inc., January 25, 2018.

believed to be separated by natural geologic materials that remained in place during placement of waste in the various units or during excavation associated hard rock quarrying operations.

The ISL is located in the western portion of the Site, southwest of the CDL and west of the Bridgeton Landfill. Historic records indicate that the wastes disposed of in the ISL consist primarily of municipal sanitary wastes.

Data collected during the Operable Unit 2 Remedial Investigation (RI) indicated that a Remedial Action (RA) was warranted for the ISL. Accordingly, a Feasibility Study (FS) was prepared to evaluate the appropriate RA for the ISL under CERCLA. This included requirements for evaluation of potential landfill gas migration. This EGMP has been prepared in response to this requirement.

2.0 SITE ENVIRONS AND GAS MIGRATION MONITORING NETWORK

The entire West Lake Landfill Superfund Site consists of approximately 200-acres located within the City of Bridgeton, St. Louis County. The formal site address is 13570 St. Charles Rock Road. The Site is bounded on the north by St. Charles Rock Road and on the east by Taussig Road and agricultural land. Old St. Charles Rock Road borders the southern and western portions of the Site. Property north of the Site (across St. Charles Rock Road) is moderately developed with commercial retail and industrial operations. The property northeast of the Site is also developed for commercial uses. The property south of the Site is currently experiencing significant commercial development. The Earth City Industrial Park is adjacent to the Site on the west. The Site is now almost completely surrounded by commercial/industrial properties.

2.1 Topographic Setting

The Site is located in the eastern edge of the Missouri River flood plain. The Missouri River is located less than two miles west of the Site. The Site area is transitional between the alluvial flood plain immediately to the west and the loessial bluffs 0.5 mile to the east. The edge of the alluvial valley is oriented northeast to southwest through the center of the Site. Topography in the area is gently rolling. However, the Site's topography has been significantly altered by quarry activities in the eastern portion (Bridgeton Landfill) and placement of mine spoils (unused quarry rock) and landfilled materials in the western portion in which the ISL is located.

2.2 History of Waste Placement

The ISL, CDL and Bridgeton Landfill operating history is complex and includes numerous and specific disposal authorizations. A detailed discussion of these initial and subsequent waste disposal activities are documented in prior Site investigation reports.[3] Disposal authorizations for the ISL were limited to municipal solid waste. Based on review of boring logs within the presumed

[3] Refer to Section 3.3.1, Remedial Investigation Addendum, West Lake Landfill Operable Unit 1, Engineering Management Support, Inc., January 25, 2018.

limit of waste (Appendix B), materials encountered are consistent with operation as a sanitary landfill.

Estimated waste boundaries are depicted on Figure 2[4]. Additional documentation of waste limits will be completed during Remedial Design (RD) "Existing Conditions" investigation, expected to be completed in August 2020. Unless these limits are modified via this field investigation or other information gathered pursuant to the RD, the estimated limits identified in Figure 2 will be used for development of this EGMP.

2.3 Radius of Evaluation

Consistent with conventional landfill gas migration assessments, and published EPA guidance[5], a 1,000 foot radius from the presumed limit of waste is established within this EGMP for the purpose of evaluating off-site receptors. Off-site structures assumed to currently be occupied, or structures that can accommodate occupancy for periods of time exceeding one-hour or more, within 1,000 feet of the ISL boundary (currently assumed as the limit of waste) are illustrated on Figure 2. For the purpose of this EGMP, structures are defined as those having an enclosed occupancy space. Facilities that are considered "open" or not enclosed are also identified for reference. Those structures within the OU-2 Site boundary are not specifically identified as they are addressed in the EGMP previously prepared for the Bridgeton Landfill.

2.4 Potential Explosive Gas Migration Pathways.

Within the western perimeter of the site, and within a 1,000 foot radius from the assumed limit of waste in the ISL, potential subsurface pathways include a fiber optic system and embedded fence posts associated with the facility perimeter fence. In addition, a sanitary sewer parallels Old St. Charles Rock Road which services leachate discharge from the Bridgeton Landfill. It is noted that the location of this infrastructure is being formally documented by the Remedial Design

[4] For the purposes of this EGMP, estimated waste boundaries are assumed consistent with the site boundary established in the Remedial Design Work Plan previously issued for the facility.
[5] Guidance for Evaluating Landfill Gas Emissions from Closed or Abandoned Facilities, EPA-600/R-05/123a, September 2005.

investigation (RD) via an "Existing Conditions" investigation, expected to be completed in August 2020.

Both the fiber optic and sanitary sewer are categorized as linear infrastructure that may intercept and transmit landfill gas to occupied structures via service entrances. However, within the 1,000 radius of the Site, no buildings that do not currently include gas alarms are known to have service entrances associated with these utilities.

2.5 Other Potential Sources of Explosive Gas.

Other potential sources of explosive gas at the facility are primarily associated with the adjacent Bridgeton Landfill. In addition, based on regional geology, the potential for lenses of buried naturally occurring organic materials associated with alluvial events cannot be discounted as potential sources of explosive gas.

2.6 Hydrogeologic and Geological Information.

The regional direction of groundwater flow is in a generally northern direction within the Missouri River alluvial valley, parallel or subparallel to the river alignment. The RI data indicate very flat gradients in the water table of the alluvial aquifer near the ISL. Groundwater characterization specific to the ISL, including evaluation of groundwater gradients, will be completed following investigation of Operable Unit 3.

The western portion of the ISL is also bounded by a flood control canal operated by the Earth City Levee District. Groundwater elevations under the ISL are expected to vary in response to canal water elevation and to a lesser extent, groundwater and leachate withdrawal via pumping well K-128, located at the southeast margin of the ISL (Figure 2). The primary importance of this interaction is potential variation in groundwater elevations within probable gas migration zones. Such fluctuation may alter gas migration patterns temporally, and thus must be considered in the placement and specifically depth of gas monitoring wells.

Based on review of stormwater application requirements set forth by the Earth City Levee District, stormwater canals are designed with a normal water surface elevation of 433.0 (Earth City Levee District datum). Various aerial surveys generally confirm the water surface resides at this elevation. Therefore, under the assumption of direct communication between the canal and alluvial deposits underlying the ISL, canal water surface elevations are assumed to impart significant influence on the depth of the unsaturated zone available for gas migration along the western perimeter of the ISL.

2.6.1 Natural Site Characteristics that May Act as Natural Impervious Boundaries to Gas Migration or Allow Natural Venting of Gas.

As previously indicated, groundwater elevations under and along the perimeter of the ISL are expected to vary in response to canal water elevation and to a lesser extent, leachate withdrawal from the pumping well K-128 (Figure 2). In terms of site characteristics that may influence gas migration, this interaction is deemed as the most significant with respect to factors that may influence the unsaturated zones available for gas migration.

In addition to groundwater, the perimeter berm present along the western boundary of the ISL may also impact gas migration. At this time, the composition of this berm is not known, but will be defined through the course of ISL RD investigations (anticipated to be completed the third quarter of 2020). If this berm is comprised of low permeability soils and was properly constructed as a gas and/or leachate migration barrier, it will represent an additional barrier to gas migration. However, characterization of this berm is not expected to significantly alter the proposed placement of gas migration monitoring wells identified in this EGMP.

2.6.2 Potential Explosive Gas Migration Pathways and Their Associated Explosive Gas Hazard.

The primary explosive gas migration pathway identified in this EGMP consists of the alluvial deposits underlying and surrounding the ISL, principally those on the western perimeter of the site.

As these deposits are expected to be highly variable in terms of gas transmissivity potential and may also vary in spatial terms, the principal concern regarding gas migration monitoring is adequate coverage of potential transmission pathways including potentially discrete zones of migration that may occur within complex and highly variable alluvial deposits.

In addition to these alluvial deposits, two utility corridors including fiber optic and a sanitary sewer run parallel to Old St. Charles Rock Road on the western perimeter of the ISL. Each represents a potential migration pathway. However, as gas must migrate through alluvial deposits prior to reaching these utility corridors, the alluvial deposits are considered as the primary migration pathway.

2.7 Identification of Other Sources of Explosive Gases.

As the ISL is located at a facility with multiple waste disposal units, there is potential for migration of explosive gas emanating from the Bridgeton Landfill through or around the ISL toward the proposed ISL monitoring network. At this time, significant direct communication between waste disposal units in terms of gas migration is not anticipated. While this assumption has not been formally confirmed based on completed site investigations, ongoing or proposed facility-wide investigations will further the understanding of potential communication between disposal units and relevant findings may be amended to this EGMP if significant to ISL gas migration monitoring.

In addition, due to the presence of a significant gas extraction system within the Bridgeton Landfill, the potential for gas migration from the Bridgeton Landfill to the proposed ISL monitoring system is deemed remote at this time. The potential for gas generation from isolated zones of naturally occurring organic materials deposited during formation of the alluvial deposits underlying the ISL must also be considered.

2.8 Geologic Cross Sections and Potential Natural Pathways.

The RI previously completed for Operable Unit 1 (OU-1) at the Site included development of geologic cross-sections that traverse the ISL. These cross-sections provide considerable insight into the position of the ISL relative to regional geology and adjacent waste disposal units[6].

In general, the ISL is located over an alluvial plain, incised within a limestone bedrock formation. These alluvial deposits vary in thickness and exceed 100 feet at some locations. The current interpretation of the ISL relative to underlying and surrounding geology is that of a surface or "area" fill. Based on this interpretation, waste materials were placed directly on alluvial deposits (or mine spoil) with no significant excavation below prevailing ground surface.

Figure 5-14 presented in the OU-1 RI Addendum (Appendix C) indicates the base of ISL refuse rests in the range of 430 to 460 feet (site datum). As a means to further refine base grade, various borings advanced either within or adjacent to the ISL were also examined to determine ISL base grade. Borings noting waste content and relevant elevation data are summarized in Table 1. Borings associated with the ISL that were reviewed and associated well installation logs (as applicable) are provided in Appendix B.

TABLE 1
ESTIMATED BASE OF WASTE

Boring ID	Ground Surface Elevation (fmsl)	Depth to Base of Waste	Estimated Base of Waste	Comments
PZ-205AS	454.3	28	426.3	Waste
PZ-107SS	462.6	28	434.6	Waste
LR-105	484.2	36	448.2	Waste
LR-103	460.1	33	427.1	Decayed Vegetation
LR-102	512.0	76	436	Waste
LR-101	500.2	54.7	445.5	Waste
LR-100	467.2	27	440.2	Waste

[6] Remedial Investigation Addendum, West Lake Landfill, Operable Unit 1, Engineering Management Support, Inc., January 25, 2018.

Based on this boring data, an approximate base of waste may be established at elevation 425 fmsl. Correlating this boring data to normal water surface elevations recorded for the Levee District canal (433.0 per Earth City Levee District datum), the lower 8 to 10 feet of waste within the ISL could potentially be saturated. If this condition does occur, it may retard to some extent, both gas generation and migration within the lower portion of the waste column.

2.9 Discussion of Site Construction Details Including the Type and Characteristics of the Liner (if any), Type and Characteristics of Final Cover, and an Evaluation of Existing Cover Conditions.

No bottom or sidewall liners are known to have been placed within the ISL. The cover system placed following cessation of waste receipt appears to be a general soil or clay cap and was not certified. Cap thickness and engineering properties are currently under evaluation in accordance with the Remedial Design Work Plan (RDWP) and this evaluation is anticipated to be complete in the third quarter of 2020. Should existing cap characteristics be altered during RD or RA activities, impacts to potential gas migration will be reevaluated at that time.

2.10 Description of any Existing and Operating Gas Extraction or Gas Venting System.

No existing gas collection or venting system is present at the ISL. As previously indicated, an extensive active gas collection system is operating at the adjacent Bridgeton Landfill. The impact of the adjacent gas collection system on migration patterns within the ISL has not been defined. However as the potential gas migration monitoring zone is on the western perimeter of the ISL, minimal impact from the Bridgeton Landfill active gas collection system is expected to occur.

2.11 Description of Any Existing Explosive Gas Monitoring System and an Evaluation of its Effectiveness.

No existing monitoring system is in operation at the ISL. A comprehensive monitoring program is active at the neighboring Bridgeton Landfill. To date, this Bridgeton Landfill EGMP has been

deemed effective at detecting gas migration from the Bridgeton Landfill, and mitigating off-site impacts to occupied structures or associated properties.

2.12 Review of Explosive Gas Generation Potential.

In general, prior investigation of the Site concluded that gas generation potential is "low" due to the relative age of refuse as well as "closed" conditions. As indicated in Section 5.3 and 12.2 of the ROD"

> *"Landfill gas characterization of the Inactive Sanitary Landfill was accomplished using various measurement techniques. Air monitoring of the breathing zone conducted during 49 borings did not show appreciable impacts from landfill gas. Active gas venting was not observed. Direct measurements of landfill gas were made along the crest of the landfill. Measurements along the western perimeter were also taken. Sporadic impacts from combustible gas emissions and volatile organic compounds (VOCs) were observed."*
>
> *"Landfill gas characterization of the Inactive Sanitary Landfill indicated the sporadic presence of decomposition gases and organic vapors. Typically, gas generation in municipal solid waste increases for the first five or six years after placement in the landfill and then declines thereafter. Because the landfill has been inactive for 30 years, decomposition gas generation is relatively low and expected to decline. However, even at low generation rates, placement of the landfill cover creates the potential for gases to be trapped and accumulate under the cover. To prevent pressure build up under the landfill cover and/or lateral migration, gas control systems may be required. Gas control measures may involve passive venting or active collection. The need for and nature of gas control measures will be evaluated and defined as part of the RD."*
>
> *(Refer to Sections 5.3, 9.2, 12.2 and 13.2 of the ROD for additional discussion on gas generation assessments conducted during prior Site investigations.)*

Based on the results of these prior investigations as well as ongoing investigations at the ISL and adjacent sites, data collected to date suggest that gas generation potential remains "low".

2.13 Review and Summary of Historical Records Pertaining to Explosive Gas Investigations.

As indicated in the ROD, investigation of explosive gas was generally related to, or coordinated with various intrusive investigations conducted for the purposes of initial site characterization. As

indicated in Section 2.12, limited gas generation (and therefore limited gas migration) potential was inferred through observation of both surface and subsurface Site conditions. Refer to Sections 5.3, 9.2, 12.2 and 13.2 of the ROD for additional information on these historical investigations.

2.14 Discussion of the Latest Explosive Gas Investigation for this Site.

As indicated in the ROD, the OU-2 RI was conducted to characterize affected media associated with the CDL, Bridgeton Landfill and the ISL. The RI included studies of the physical and biological characteristics, hydrogeologic characteristics, sources of contamination, surface and sediment quality, and air quality. Source characterization activities conducted for the ISL included landfill gas and leachate characterization. The findings of this characterization related to ISL landfill gas are briefly summarized below.

The landfill gas characterization of the ISL was accomplished using various measurement techniques. Air monitoring of the worker breathing zones conducted during advancement of 49 borings did not show appreciable impacts from landfill gas. Active gas venting was not observed. Direct measurements of landfill gas were made along the crest of the landfill. Measurements along the western perimeter were also taken. Sporadic impacts from combustible gas emissions and volatile organic compounds (VOCs) were observed.

In addition to findings documented during the RI, a site reconnaissance was conducted in March 2020 by CEC personnel and various site representatives. This reconnaissance included a walking tour of the landfill cap, site perimeter and various potential gas venting locations such as surface water ditches, cap transition areas and the entire western perimeter of the landfill. During this activity, no observed evidence of surficial gas migration was recorded which is consistent with findings of the RI conducted approximately 15 years prior.

2.15 Proposed Explosive Gas Monitoring System

2.15.1 Proposed Permanent Monitor and/or Punch Bar Station Locations, Depths, Screen Intervals, and Identification Designations.

The proposed permanent monitor system is illustrated on Figure 2. The system includes six dedicated gas monitoring wells, advanced to elevation 425 (fmsl) which is equivalent to the maximum estimated depth of the base of waste within the ISL. Should ongoing field investigations determine an alternate estimated base of waste, installation of supplemental wells or screened intervals may be evaluated at that time.

As the ISL is bounded by waste disposal facilities on the south, east and northern perimeters, only the western and southwestern perimeter is currently identified for permanent gas monitor placement at this time. Based on monitoring results obtained in these locations, the need for additional on-site or off-site monitoring wells will be evaluated as a component of required contingency monitoring plans (see Section 2.18).

The proposed gas monitoring wells are spaced at a maximum distance of 500 feet. Well depth, based on the ground surface elevations (approximate elevation is 450 fmsl) adjacent to the western perimeter of the ISL is approximately 25 feet.

Due to the expected heterogeneity of alluvial deposits within the proposed monitoring zone, each well will be screened continuously from 5 feet below ground surface to elevation 425 fmsl. The upper 5 feet will consist of a well bore seal and concrete anchor for well protective casings.

In consideration of the importance of groundwater levels relative to potential gas migration, each well will be fitted with a slip cap, thereby facilitating routine water level measurements. Each slip cap is also configured with a quick connect type fitting, thereby allowing measurement of well gas pressures and gas composition in a “sealed” configuration. The order of data collection will be of some level of importance given this well configuration and will be discussed in greater detail in Section 2.17.

2.15.2 Proposed Punch Bar or Temporary Monitors.

At this time, no punch bar monitoring stations or similar "temporary" monitoring facilities are proposed. Should gas migration be positively identified in the permanent well network, the addition of temporary monitoring stations will be evaluated at that time.

2.15.3 Proposed In-building Combustible Gas Alarms and Monitoring

At this time, only one occupied structure is located within 1,000 feet of the estimated limits of waste placement that does not currently utilize gas alarms. As this structure is located on the western side of the Earth City Levee Canal, no in-building alarms are currently installed or proposed for installation at this location. Should any positive detections of landfill gas above applicable thresholds in the permanent monitoring network be observed, evaluation of the need for in-building alarms will be conducted in accordance with contingency monitoring protocol set forth in Section 2.18.

2.16 Methods of Construction or Specifications for the Monitoring System.

Specifications related to permanent well installation are provided in Appendix D.

2.17 Explosive Gas Monitoring, Sampling and Reporting Procedures.

2.17.1 Monitoring Frequency.

In accordance with schedules associated with the OU-2 RDWP, the following monitoring schedule has been established for the permanent gas well network.

- Weekly – January 8, 2021 through February 16, 2021;
- Monthly – March 19, 2021 through July 4, 2021; and,
- Quarterly – July 21, 2021 through end of the established post closure monitoring period.

2.17.2 Parameters to be Monitored Including Detailed Step-by-Step Instructions of the Proper Procedures to be Utilized in Conducting Monitoring.

The following parameters shall be monitored at all permanent and temporary monitoring locations, as noted, in the following order:

- Gas pressure in the permanent monitoring well.
- Initial combustible gas concentration in percent methane by volume (the monitoring well should not be vented prior to measuring the concentration of combustible gas).
- Water level in the permanent well.
- Ambient barometric pressure.
- Ambient air temperature.
- Observed weather conditions (sunny, overcast, recent precipitation, snow cover, etc.).
- Observations related to potential gas generation (odors, distressed vegetation, etc.).

  Note: The monitoring equipment shall have a detection limit below twenty-five percent of the lower explosive limit. For the purposes of this EGMP "initial" means immediately after the gas pressure measurement so as not to inadvertently vent the monitor.

2.17.3 Data Reporting.

Results of this monitoring shall be transmitted to U.S. EPA at least quarterly within the framework of CERCLA monthly status/progress reports. MDNR will be provided copies via electronic submission. Both U.S. EPA and MDNR monitoring reports will be provided in a format and manner as prescribed by MDNR per current data reporting procedures.

2.18 Contingency Procedures.

2.18.1 Relevant Contingency Thresholds.

The established threshold for implementation of contingency procedures are established as follows. Note that thresholds apply to current conditions at the site, and also extend to future

conditions including the installation of any buildings, enclosures or similar potentially occupied structures that may be required as a component of the RA activities:

- Twenty-five percent (25%) of the lower explosive limit (LEL) or one and one quarter percent (1.25%) by volume for methane in buildings on the Bridgeton Landfill property (if located in the future); and
- Fifty percent (50%) of the LEL or two and one-half percent (2.5%) by volume for methane in the soil at the property boundary of the ISL.

Contingency procedures will consist of the following:

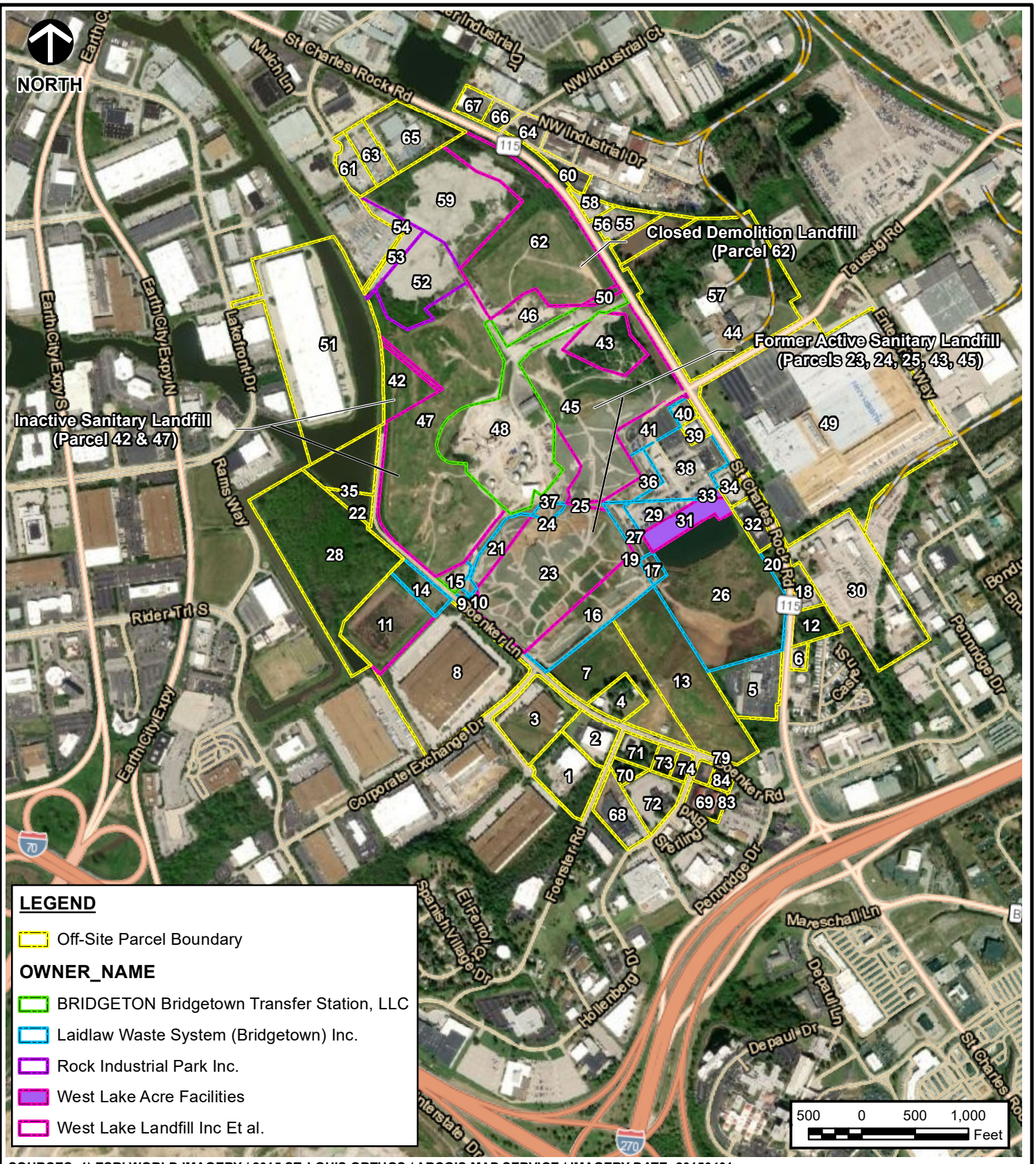
- If methane gas levels exceeding the limits specified in this EGMP, Bridgeton Landfill, LLC shall:
    - Immediately evaluate the potential for methane accumulation in on-site and off-site buildings;
    - Immediately evaluate measures to reduce methane concentrations at monitored property boundaries to below compliance levels;
    - Notify U.S. EPA and MDNR and immediately take all necessary steps to ensure protection of public health and safety including;
        - Within 7 days of detection, submit to U.S. EPA and MDNR a report describing the steps taken to protect public health and safety;
        - Within 60 days of detection, submit to U.S. EPA and MDNR for approval a remediation plan designed by a professional engineer for the methane gas releases;
        - Remediation plans shall describe the nature and extent of the problem and the proposed remedy. The plan shall be implemented upon departmental approval; and
        - U.S. EPA or MDNR may establish alternative schedules reports and remediation plans for demonstrating compliance per 10 CSR 80-3.010(14)(E).
    - When results of monitoring in on-site or off-site structures indicate levels in excess of those specified, immediate and appropriate action shall be taken to mitigate the effects of landfill gas accumulation in those structures until a permanent remediation is completed. Actions which must be undertaken include:
        - Notification of the fire department or other appropriate local public safety authorities. These include:
            - Bridgeton Fire and Police Department - 911
            - Missouri Emergency Response Unit - (573) 634-2436

    - MDNR Solid Waste Management Program - (573) 751-5401
    - St. Louis County Department of Public Health - (314) 615-4116
- Notification of adjacent property owners and/or occupants;
- Ventilation of any confined spaces that may trap decomposition gases or the installation of alarm systems in any confined spaces that may trap decomposition gases; and
- Establishment of a temporary methane monitoring program in affected structures.

2.18.2 Contingency Monitoring

Contingency monitoring shall continue at no less than a weekly frequency until observation of four consecutive monitoring events indicating compliance with applicable gas thresholds. These four consecutive events shall be undertaken over a period of not less than two weeks.

FIGURES



SOURCES: 1) ESRI WORLD IMAGERY / 2015 ST. LOUIS ORTHOS / ARCGIS MAP SERVICE / IMAGERY DATE: 20150401

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WESTLAKE LANDFILL OU-2
INACTIVE SANITARY LANDFILL EGMP

SITE VICINITY AND AERIAL MAP

DRAWN BY:	MHS	CHECKED BY:	RH	APPROVED BY:	RH	FIGURE NO:	1
DATE:	JULY 02, 2020	DWG SCALE:	1 " = 1,250 '	PROJECT NO:	191-750		

Signature on File *

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LEGEND

- 1000-Foot Buffer
- Inactive Sanitary Landfill Assumed Limit of Waste
- Approximate Extent of Canal
- Proposed Gas Monitoring Locations (ISL)
- Leachate Pumping Well

Property Boundary

- Bridgeton Transfer Station
- Laidlaw Waste Systems Bridgeton Inc
- Rock Road Industries Inc
- West Lake Landfill Inc

SOURCE:
1) ESRI WORLD IMAGERY / ARCGIS MAP SERVICE / IMAGERY DATE: 2019.
2) OPERABLE UNIT 2 LANDFILL BOUNDARY AND LOCAL TOPOGRAPHY PROVIDED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC DRAWING "FIGURE A-4 - APPROXIMATE LOCATIONS OF PROPOSED TEMPORARY LANDFILL GAS PERIMETER MONITORING," DATED 2008.

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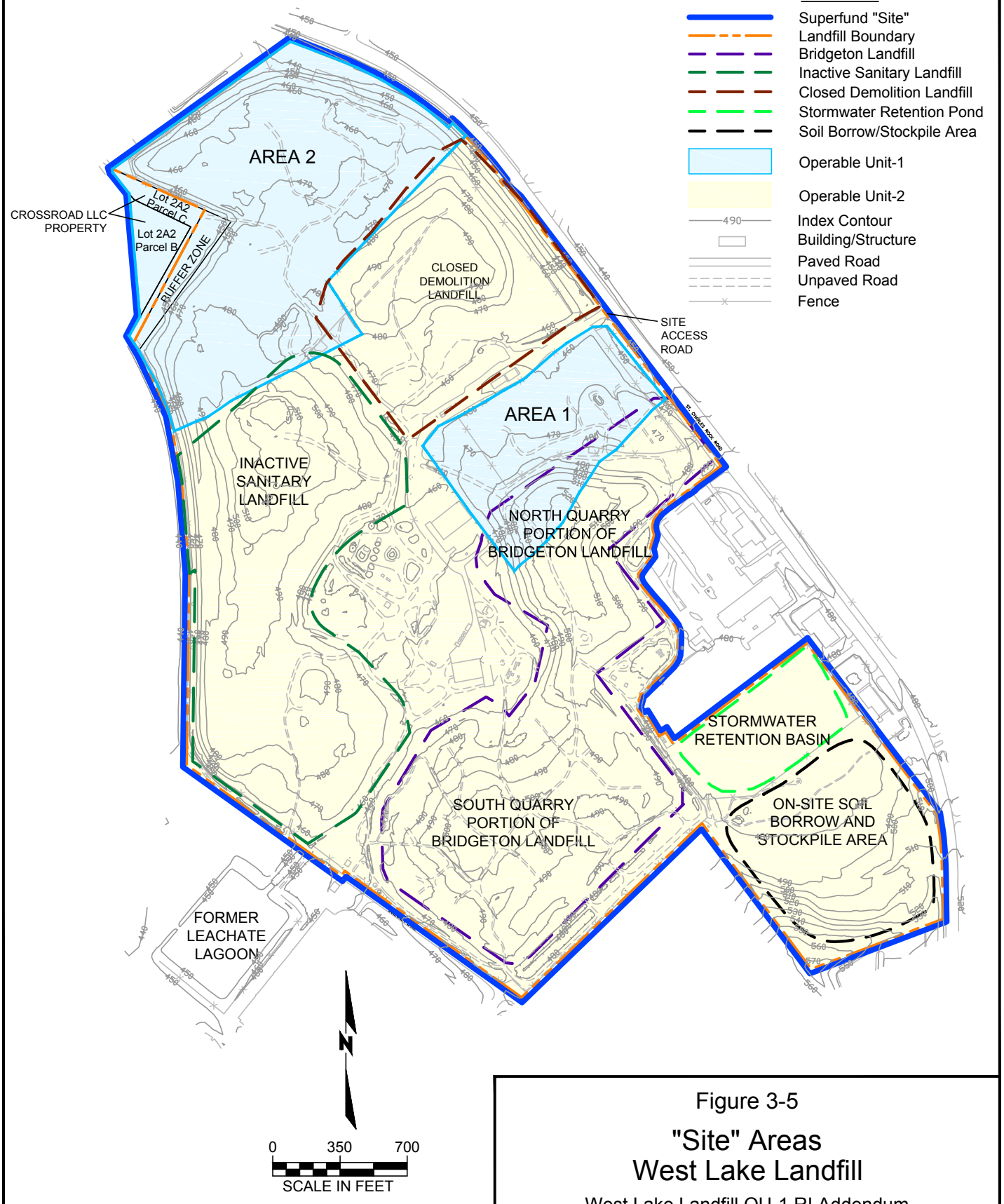
DRAWN BY:	MHS	CHECKED BY:	RH	APPROVED BY:	RH	FIGURE NO:	2
DATE:	JULY 07, 2020	DWG SCALE:	1 " = 400 '	PROJECT NO:	191-750		

WESTLAKE LANDFILL OU-2
INACTIVE SANITARY LANDFILL EGMP

SITE BOUNDARY AND 1,000 FT RADIUS MAP

Signature on File *



Notes:

- Aerial Topography Provided By Cooper Aerial Surveys Co. and is Dated December 2, 2016
- All Elevations Are Above Mean Sea Level (amsl)

Figure 3-5

"Site" Areas
West Lake Landfill

West Lake Landfill OU-1 RI Addendum

EMSI Engineering Management Support, Inc.

M:\clients\EMSI\westlake\2017RI-Addendum-edits\Section-3\FIG 3-5-Site-Areas.dwg 1/22/2018

APPENDIX A

APPLICABLE REGULATIONS (10 CSR 80-3.010(14) (2008))

obtained from the local pollution control agency. The operating procedures and location for burning practices shall be submitted to the department for review and written approval. Burning at the sanitary landfill shall be conducted in accordance with Chapter 643, RSMo, the corresponding rules, the terms conditions, or both, of the plans, permit, or both, and all local requirements.

(14) Gas Control.

(A) Requirement. Decomposition gases generated within the sanitary landfill shall be controlled on-site, as necessary, to avoid posing a hazard to the environment or to public health and the safety of occupants of adjacent property.

(B) Satisfactory Compliance—Design.

1. Plans shall contain a monitoring program capable of detecting decomposition gas migration.

A. The monitoring program must specify the type of monitoring and be based on—

(I) Soil conditions;

(II) The hydrogeologic and topographic conditions surrounding the facility; and

(III) The location of facility structures, property boundaries, and off-site features.

B. The monitoring program described in the plans must include:

(I) A written description of the monitoring system, including spacing of monitoring locations and frequency of monitoring;

(II) The results of any gas assessment that has been performed;

(III) The location of all gas monitoring wells shown on a plan sheet;

(IV) A drawing detailing the typical gas monitoring well design;

(V) The design depths and bottom elevations of the gas monitoring wells; and

(VI) Boring logs that support the design gas monitoring well depths.

C. The gas monitoring specified in the plans shall be performed at gas monitoring wells. The monitoring program shall specify how buildings on the landfill property are to be monitored. Gas monitoring wells shall be designed to monitor the unsaturated soil and rock down to an elevation equal to the bottom elevation of the landfill. Gas monitoring wells shall be placed between the landfill and off-site buildings and other features that may be harmed by landfill gas or may easily transmit gas from the landfill. Gas monitoring well locations at the property boundary shall not be more than five hundred feet (500') apart unless the permittee can show that the potential for gas migration is low.

2. Plans shall assess the need for gas control and indicate the location and design of any vents, barriers or other control measure to be provided.

A. The gas control system shall be constructed of materials that are chemically resistant to the solid wastes managed in the sanitary landfill and the gas expected to be generated. These materials shall be specified in the engineering report and the choice of materials justified.

B. The gas control system shall be constructed of materials that are of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying solid wastes, cover and by any equipment used at the sanitary landfill. Overburden pressure calculations, material specifications and system installation procedures shall be included in the engineering report.

C. Maintenance and repair options shall be considered in the design and specified in the engineering report.

D. All applicable permits and approvals necessary to comply with the requirements of the Air Conservation Law and rules promulgated shall be obtained from the department.

E. The plan shall estimate the maximum anticipated rate of gas generation at the disposal area and the length of time over which it is anticipated to be generated. The method by which these calculations are arrived at shall also be included.

(C) Satisfactory Compliance—Operations.

1. Decomposition gases shall not be allowed to migrate laterally from the sanitary landfill to endanger public health and safety or to pose a hazard to the environment. They shall be controlled on-site, flared or vented to the atmosphere directly through the cover, cut-off trenches or ventilation systems in a way that they do not accumulate in explosive or toxic concentrations, especially within structures. (Information on the limits of flammability of gases is available in such references as the *Handbook of Chemistry and Physics*, 68th ed. Cleveland, Chemical Rubber Publishing Co., 1987.)

2. Decomposition gases shall not be allowed to concentrate above the following levels:

A. Twenty-five percent (25%) of the lower explosive limit (LEL) or one and one-quarter percent (1.25%) by volume for methane in buildings on the sanitary landfill property; and

B. Fifty percent (50%) of the LEL or two and one-half percent (2.5%) by volume for methane in the soil at the property boundary of the sanitary landfill.

3. For purposes of this section, lower explosive limit (LEL) means the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at twenty-five degrees Celsius (25°C) and atmospheric pressure.

4. Owners/operators of all sanitary landfills shall implement a methane monitoring program capable of detecting decomposition gas migration in the most likely zone(s) of migration, to ensure that the standards of paragraph (14)(C)2. of this rule are met. Methane monitoring shall be conducted at least quarterly with equipment warranted by the manufacturer to detect explosive gases under the conditions the equipment is to be used. Facilities shall submit the results of this methane monitoring to the department at least quarterly. The electronic submission of methane monitoring data is required. This submission shall be in a format and manner as prescribed by the department.

5. If methane gas levels exceeding the limits specified in paragraph (14)(C)2. of this rule are detected, the owner/operator shall—

A. Notify the department and immediately take all necessary steps to ensure protection of public health and safety which include:

(I) When results of monitoring in on-site or off-site structures indicate levels in excess of those specified, the operator shall take appropriate action to mitigate the effects of landfill gas accumulation in those structures until a permanent remediation is completed. Actions which must be undertaken include:

(a) Notification of the fire department or other appropriate local public safety authorities;

(b) Notification of adjacent property owners and/or occupants;

(c) Ventilation of any confined spaces that may trap decomposition gases or the installation of alarm systems in any confined spaces that may trap decomposition gases; and

(d) Establishment of a temporary methane monitoring program in affected structures.

B. Within seven (7) days of detection, submit to the department a report describing the steps taken to protect public health and safety;

C. Within sixty (60) days of detection, submit to the department for approval a remediation plan designed by a professional engineer for the methane gas releases. A gas control system shall be designed to—

(I) Prevent methane accumulation in on-site and off-site buildings;

(II) Reduce methane concentrations at monitored property boundaries to below compliance levels; and

(III) Reduce methane concentrations off-site to below compliance levels;

D. Landfill gas corrective action plans shall describe the nature and extent of the problem and the proposed remedy. The plan shall be implemented upon departmental approval; and

E. The department may establish alternative schedules for demonstrating compliance with subparagraphs (14)(C)5.B. and C. of this rule.

6. The sanitary landfill shall operate in compliance with all applicable requirements of Chapter 643, RSMo and corresponding rules.

(15) Vectors.

(A) Requirements. Conditions shall be maintained that are unfavorable for the harboring, feeding and breeding of vectors.

(B) Satisfactory Compliance—Design. Plans shall include contingency programs for vector control and the operator shall be prepared at all times to implement those procedures.

(C) Satisfactory Compliance—Operations. Vector control contingency programs shall be implemented when necessary to prevent or rectify vector problems.

(16) Aesthetics.

(A) Requirement. The sanitary landfill shall be designed and operated at all times in an aesthetically acceptable manner.

(B) Satisfactory Compliance—Design. Plans shall include an effective litter control facility and operating program.

(C) Satisfactory Compliance—Operations.

1. Portable litter fences or other devices shall be used in the immediate vicinity of the working face and at other appropriate locations to control blowing litter. At the end of each operating day, or more often as required, litter shall be removed from the fences and the ground and incorporated into the cell being used. Alternatively, the litter may be containerized for disposal on the next operating day.

2. Solid wastes that are easily moved by wind shall be covered, as necessary, to prevent becoming airborne and scattered.

3. On-site vegetation should be cleared only as necessary. Natural windbreaks, such as green belts, should be maintained where they will improve the appearance and operation of the sanitary landfill.

4. Salvage operations shall be conducted in such a manner as to not detract from the appearance of the sanitary landfill. Salvaged materials shall be removed from the sanitary landfill daily or stored in aesthetically acceptable containers or enclosures.

(17) Cover.

(A) Requirement. Cover shall be applied to minimize fire hazards, infiltration of precipitation, odors and blowing litter; control gas venting and vectors; discourage scavenging; and provide a pleasing appearance.

(B) Satisfactory Compliance—Design. The owner/operator shall prepare a written closure plan that describes the steps necessary to close all sanitary landfill phases at any point during the active life of the sanitary landfill in accordance with the requirements of 10 CSR 80-2.030(4)(A). In addition, the final cover requirements specified in the closure and post-closure plans shall specify—

1. Cover sources, quantities and soil classification (Unified Soil Classification System or United States Department of Agriculture classification system);

2. The capability of the cover to perform the functions listed in subsection (17)(A) of this rule;

3. Surface grades and side slopes needed to promote maximum runoff, without excessive erosion, to minimize infiltration. Final side slopes shall not exceed twenty-five percent (25%) unless it has been demonstrated in a detailed slope stability analysis approved by the department that the slopes can be constructed and maintained throughout the entire operational life and post-closure period of the landfill.

4. Procedures to establish and maintain vegetative growth to combat erosion and improve appearance of idle and completed areas. Procedures shall include seeding rate, fertilizer rate, soil conditioning rate and provisions for mulching;

5. Procedures to maintain a cover integrity, for example, regrading and recovering;

6. Methods for borrow areas to be reclaimed so as to restore aesthetic qualities and prevent excessive erosion;

7. The final slope of the top of the sanitary landfill shall have a minimum slope of five percent (5%); and

8. Shear failure analyses shall be included where intermediate or final slopes exceed twenty-five percent (25%). However, the department will waive the analysis for slopes of twenty-five percent (25%) or less, except in seismic impact zones.

(C) Satisfactory Compliance—Operations.

1. Cover shall be applied by the end of each operating day regardless of weather; sources of cover, therefore, shall be accessible on all operating days. The thickness of the compacted cover shall not be less than six inches (6"). Sanitary landfills operating twenty-four (24) hours per day shall incorporate all solid waste into one (1) or more cells at least every twenty-four (24) hours. Where a liner and leachate collection system are in place, an alternative daily cover may be approved by the department on a site-specific basis, if the owner/operator demonstrates that the alternative material controls run-on, runoff, disease vectors, fires, odors, blowing litter and scavenging without presenting a threat to human health and the environment.

2. Cover shall be increased to a total thickness of at least one foot (1') of compacted cover on filled areas of the sanitary landfill which are idle for more than sixty (60) days.

3. No active, intermediate or final slope shall exceed thirty-three and one-third percent (33 1/3%).

4. As each phase of the sanitary landfill is completed, a final cover system shall be installed at portions of—

A. Existing sanitary landfills without composite liners. This final cover shall consist of at least two feet (2') of compacted clay with a coefficient of permeability of 1×10^{-5} cm/sec or less and overlaid by at least one foot (1') of soil capable of sustaining vegetative growth;

B. Sanitary landfills with composite liners. This final cover shall consist of component layers, in order from top to bottom, as follows:

(I) Two feet (2') of soil capable of sustaining vegetative growth;

(II) A drainage layer;

(III) A geomembrane liner at least as thick as the geomembrane liner described in subparagraph (10)(B)1.G.;

(IV) One foot (1') of compacted clay with a coefficient of permeability of 1×10^{-5} cm/sec or less; and

C. The geomembrane liner shall be in intimate contact with the underlying compacted clay.

5. The installation of the final cover systems shall include provisions for slope stability.

6. The department may approve the use of an alternative final cover system provided that the owner/operator can demonstrate to the department that the alternative design will be at least equivalent to the final cover system described in paragraph (17)(C)3. of this rule.

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Sampling of Landfill Gas Monitoring Wells

Technical Bulletin
9/1999

Division of Environmental Quality
Solid Waste Management Program

Overview

This document was prepared by the Missouri Department of Natural Resources' Solid Waste Management Program (SWMP) to provide guidance regarding the quarterly sampling of gas monitoring wells as required by 10 CSR 80-3.010(14) and 10 CSR 80-4.010(14). This guidance applies to all landfills that monitor for methane migration by means of gas monitoring wells. Sampling results must be submitted at least quarterly to SWMP in an electronic format.

Sampling Equipment

Proper selection of sampling equipment is critical in obtaining true soil gas concentrations. Explosimeter-type instruments are not appropriate for measuring methane in gas monitoring wells, because the amount of oxygen which is present in the well may not be sufficient for the sample to "burn." These instruments will typically give false low readings when high concentrations of methane are present.

It is recommended that instruments used to sample gas monitoring wells have an automatic pump that has the ability to withdraw enough volume to bring a fresh sample of soil gas into the well. It is also beneficial that the instrument reads both oxygen and methane concentrations. Some instruments have the ability to read barometric pressure, which is also desirable.

Sampling Procedures

Step 1 - Make sure the instrument is properly calibrated. Prepare the instrument for sampling by allowing it to properly warm up as directed by the manufacturer.

Step 2 - Connect the instrument to the well head and begin collecting a sample.

Step 3 - Continue collecting the sample until the reading stabilizes. A stable reading is one that does not vary more than 0.5 percent by volume on the instrument's scale.

Step 4 - A proper reading should have 2 percent oxygen by volume or less. If levels of oxygen are higher, it may indicate that air is being drawn into the system giving a false reading of the true soil gas concentrations. Possible explanations for this problem are:

A. The gas monitoring well seal has failed;
B. Well head connectors are leaking; or
C. A connection at the instrument is leaking.

When the problem is eliminated repeat Steps 1-3. If the problem cannot be corrected, record those values and make sure that the problem is well documented in the report sent to the department.

PUB002053

Step 5 - Record the stabilized reading including the oxygen concentration and barometric pressure, if available.

Obtaining true soil gas concentrations from gas monitoring wells is dependent upon using a consistent proven method. If you have problems using the sampling procedures described, you should contact the department as soon as possible.

Sampling Times

Sampling times are almost as important as the procedure used to collect the sample. Proper monitoring of the site should include sampling at those times when landfill gas is most likely to migrate. Scientific evidence indicates that weather and soil conditions influence when gas will migrate. For these reasons sampling should be considered when:

A. Barometric pressure is low and soils are saturated; or
B. When snow cover is just beginning to melt; or
C. The ground is frozen or ice covered.

Records

The Solid Waste Management Regulations require that reports on data collected from wells be submitted to SWMP at least quarterly. The SWMP recommends that gas monitoring be conducted during the months of February, May, August and November and that the results be submitted within 30 days of sampling. The data must be submitted in electronic form. The results submitted should contain:

1. The location of monitoring points.
2. Sample results obtained should include the date the sampling was performed and the barometric pressure, if available. Methane measurements may be given as a percentage of the total air volume or as a percentage of the Lower Explosive Limit (LEL). The following formula can be used to convert a percentage of LEL into a percentage methane by volume:
   % Methane (by volume) = LEL (%) ÷ 20
3. The amount of time a well is pumped before a stabilized methane reading is taken.
4. The percent volume of O_2 (if the instrument used is capable of measuring).

The form attached to the end of this bulletin may be used to record the information required by the department.

Conclusions

Missouri has stringent regulations governing landfill gas migration. The department prefers to address the issue of migrating gases before they present a threat to public safety or the environment.

Migrating gases detected above allowable limits at property boundaries do not necessarily mean that there is an immediate threat to public safety. It does mean that there is a potential problem that must be addressed. In order to address such a problem, a permit modification to install a gas collection system may be necessary.

References

Landtec Landfill Control Technologies, *Landfill Gas System Engineering Design: A Practical Approach*, course notes from Landfill Gas System Engineering Design Seminar, 1994.

Missouri Department of Natural Resources, Flood Grant Team, *Landfill Gas Monitoring Protocol*, available on the Solid Waste Management Program's web site.

For more information call or write:
Missouri Department of Natural Resources
Solid Waste Management Program
P.O. Box 176, Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 751-5401 office
(573) 526-3902 fax
(http://www.dnr.state.mo.us/deq/swmp) Program Home Page

Solid Waste Management Program

Quarterly Gas Monitoring Report

Facility: _____ Permit Number: _____

Name of Sample Collector: _____

Date of Observations: _____

Type of Detection Instrument Used on Wells: _____

- in Buildings: _____

Pump Rate of Instrument Used to Monitor Wells:_____

Barometric Pressure: _____ Weather Conditions: _____

Instructions: Under "Location or Well Designation" identify the monitoring wells or describe the location for other tests (e.g., inside buildings). A drawing showing the location of test can be attached. Report methane readings in either % methane by volume, as % LEL (Lower Explosive Limit) or both. A reading in percent methane by volume can be converted to % LEL as follows:

% methane by volume = % LEL ÷ 20

Location or Well Designation	% LEL	% CH4 by volume	% O2	% CO2	Time pumped (for wells) in seconds	Comments

Location or Well Designation	% LEL	% CH4 by volume	% O2	% CO2	Time pumped (for wells) in seconds	Comments

If your facility has more gas monitoring locations than there is room on this form, please attach additional sheets listing the same information as contained on this form.

I hereby certify that the information on this form was collected by me and is correct to the best of my knowledge and belief.

_____

SIGNATURE

Submit to: *Missouri Department of Natural Resources*
Solid Waste Management Program
P.O. Box 176
Jefferson City, MO 65102-0176

Please submit electronic copies to the above address or via electronic mail at:

swmp@mail.dnr.state.mo.us

APPENDIX B

SITE BORING LOGS

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/HO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1067293.73
DATUM EASTING: 514893.56 ELEVATION 467.2

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

					DRILLING START	DRILLING FINISH
WATER LEVEL	19.0 FT.				TIME 7:30	TIME 11:00
TIME	11:55				DATE 10/04/95	DATE 10/04/95
DATE	10/04/95					
CASING DEPTH	26.0 FT.					

BORING NO. LR-100

SHEET 1 OF 2

DRILL RIG CME 750

ANGLE 90° BEARING NA

SAMPLE HAMMER

SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
0	0 6 7 4	1.7' 2.0' (85%)			(0.0-5.5 ft.) Compact, moderate yellowish brown (10YR 5/4), CLAYEY SILT, NR, damp, (CL), (FILL)		Landfill cap 1.5 ft. thick
1					@ 0.8 ft., dry	SP (1)	
2	3 1 2 2	0.9' 2.0' (45%)			From 1.5-5.5 ft., intermixed organic matter and trace waste		
3						SP (2)	
4	2 3 4	0.3' 2.0' (15%)					
5	36				@ 5.0 ft., wet (461.7) 5.5	SP (3)	0.0 ppm PID
6	3 14 5	0.6' 2.0' (30%)			(5.5-22.0 ft.) WASTE, wet		
7	3					SP (4)	
8	4 6 4	0.5' 2.0' (25%)					0.1 ppm PID
9	5					SP (5)	
10	4 2 3	0.5' 2.0' (25%)					0.0 ppm PID
11	8					SP (6)	
12	7 14 26	0.4' 2.0' (20%)					
13	11					SP (7)	
14	50/2	0.1' 2.0' (5%)				SP (8)	1.1 ppm PID

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR100

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1067293.73
DATUM EASTING: 514893.56 ELEVATION 467.2

DRILLING METHOD:
4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

WATER LEVEL	19.0 FT.			
TIME	11:55			
DATE	10/04/95			
CASING DEPTH	26.0 FT.			

BORING NO. LR-100
SHEET 2 OF 2

DRILLING START	DRILLING FINISH
TIME 7:30	TIME 11:00
DATE 10/04/95	DATE 10/04/95

DRILL RIG CME 750
ANGLE 90° BEARING NA
SAMPLE HAMMER

SURFACE CONDITIONS

DRILLING CONTR LAYNE-WESTERN

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE		REMARKS
16	8	0.2' / 2.0' (10%)			(5.5-22.0 Ft.) WASTE, wet	SP	8	
17	11 21 11					SP	9	
18	8	0.4' / 2.0' (20%)				SP	10	0.0 ppm PID
19	13 7 8							
20	4	0.6' / 2.0' (30%)			@ 19.9 ft, increasing amount of olive gray SILT intermixed with waste	SP	11	
21	5 10 5							
22	4	0.1' / 2.0' (5%)				SP	12	0.0 ppm PID
23	7 6 6							
24	5	0.8' / 2.0' (40%)				SP	13	
25	4 4 5							
26	4	0.4' / 2.0' (20%)				SP	14	0.2 ppm PID
27	5 5 7				(440.2) 27.0 (27.0-28.0 Ft.) Compact, olive gray (5Y 4/1), SILT, NR, wet, (ML), (LOESS) (439.2) 28.0			
28					End of Soil Borehole Log at 28.0 ft.			
29								

LOGGED BY B. HARRINGTON
DATE 10/9/95
CHK'D BY B. TILTON
JOB NO.: 943-2848
FILENAME: LR100

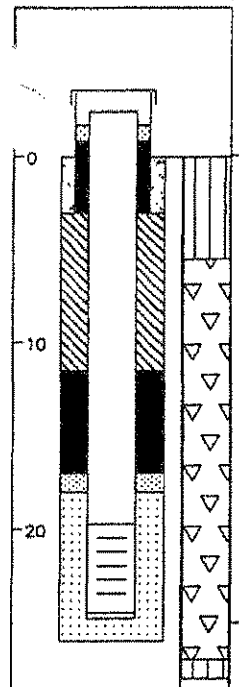
Well No. LR-100

Boring No. X-Ref: LR-100

PIEZOMETER CONSTRUCTION SUMMARY

Survey Coords: Northing: 1067294 ft.
Easting: 514894 ft.

Elevation Ground Level 467.2 ft. NGVD
Top of PVC Casing 469.12 ft. NGVD



Drilling Summary:

Total Depth 26.0 ft.
Borehole Diameter 8 1/4" (0.0-26.0')
Casing Stickup Height 1.92 ft.
Driller Layne-Western
St. Louis, MO

Rig CME 750
Bit(s) 4 1/4" ID Hollow Stem Auger Bit

Drilling Fluid None

Protective Casing 8x8" Square Steel, by 5' long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
CME 750	10/4/95	7:30	10/4/95	11:00
Geophys.Logging:				
Casing:				
2" I.D. PVC	10/4/95	12:00	10/4/95	12:10
Filter Placement:	10/4/95	12:10	10/4/95	13:05
Cementing:				
Development				
Bentonite Grout	10/4/95	14:45	10/4/95	14:55
Bentonite Seal	10/4/95	14:30	10/4/95	14:35

Well Design & Specifications

Basis: Geologic Log X Geophysical Log

Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 1.92	-	19.70	C1	469.12	-	447.50
19.70	-	24.50	S1	447.50	-	442.70
24.50	-	24.80	C2	442.70	-	442.40
	-				-	
	-				-	
	-				-	

Casing: C1 2" dia. Schedule 80 PVC, flush threaded with O-rings
C2 2" dia. threaded PVC end cap (4" long or 0.33')

Screen: S1 2" dia. Schedule 80 PVC, 0.010" machine cut slot, flush threaded with O-rings

Sand Pack: 16-35 mesh Silica Sand 18.0-26.0'

Filter Pack: 100 mesh Silica Sand 17.0-18.0'

Grout Seal: Wyo-Ben Grout Well Bentonite Slurry 3.0-11.5'

Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry 11.5-16.0'; Chips 16.0-17.0'

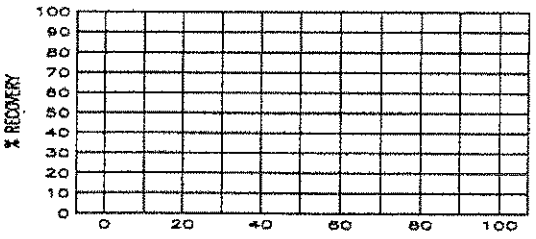
Concrete: 0.0-3.0'

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments:

Drilled to 26.0 ft. then collected split spoon sample from 26.0-28.0 ft.

Not to Scale

Supervised by B. Harrington
Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO
File Name LR100

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF. NO. 145105	
C.R. NO.	CHECK NO.
STATE WELL NUMBER	TRANSMITTAL NO.
CHECKED BY	ROUTE
APPROVED BY	ENTERED Ph 1 Ph 2 Ph 3

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

SITE/FACILITY NAME: LAIDLAW BRIDGETON SANITARY LANDFILL
WELL NUMBER: LR-100
SITE ADDRESS: ST. CHARLES ROCK RD — CITY: BRIDGETON — STATE: MO — ZIP CODE: 63044
OWNER NAME: LAIDLAW WASTE SYSTEMS, INC. — TELEPHONE: 314-241-3710
OWNER ADDRESS: 1838 N. BROADWAY — CITY: ST. LOUIS — STATE: MO — ZIP CODE: 63102

VARIANCE ISSUED: ☐ YES ☒ NO — DATE ISSUED: — VARIANCE NUMBER: V

DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT:
200' NORTHEAST OF SOUTH FENCE AND 380' NORTHWEST OF WESTERN MOST BUILDING AT SOUTH ENTRANCE OFF OLD ST CHARLES ROCK RD.

LOCATION OF WELL — SHOW LOCATION IN SECTION PLAT
COUNTY: ST. LOUIS — SURFACE ELEVATION: 467.2
SMALLEST ¼ ____ ¼ ____ ¼ ____ ¼ ____ ¼ LARGEST ¼
SEC. ____ TWN. 47 N, RNG. 5 (E) OR W
LAT. 38° 45' 53" LONG. 90° 26' 52"

MONITORING WELL INSTALLATION CONTRACTOR'S NAME: LAYNE WESTERN CO, INC. — PERMIT NUMBER: 001258 WPM
DRILLING CONTRACTOR'S NAME: LAYNE WESTERN CO., INC. — PERMIT NUMBER: 001258 WPM

WELL CONSTRUCTION INFORMATION

TYPE OF WELL: ☐ MONITORING WELL ☒ PIEZOMETER ☐ OTHER
TYPE OF POTENTIAL SITE: ☐ HAZARDOUS MATERIAL ☒ LANDFILL ☐ OTHER ☐ L.U.S.T.
MONITORING FOR: (CHECK ALL THAT APPLY) ☒ V.O.C. ☐ METALS ☐ PETROLEUM PRODUCT ONLY ☐ OTHER

PROTECTIVE CASING DETAILS (IF USED): LENGTH 5 FT. — DIAMETER OF CASING 8x8 IN. — WEIGHT OR SDR # 0.188" — DIAMETER AND DEPTH OF DRILL HOLE 8¼ IN. 26 FT. — JOINTS ☐ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER — MATERIAL ☐ THERMO PLASTIC ☒ STEEL ☐ FLUORO POLYMER TYPE — LOCKING CAP? ☒ YES ☐ NO
CAP VENTED ☒ YES ☐ NO — WEEP HOLE? ☒ YES ☐ NO
CASING GROUT DETAILS: MATERIAL ☐ CEMENT ☒ CONCRETE ☐ OTHER — DEPTH FROM THE SURFACE TO THE BOTTOM OF THE CASING GROUT SEAL 3.0 FT.
TYPE OF SURFACE COMPLETION: ☒ ABOVE GROUND ☐ FLUSH MOUNT
DESCRIBE HOW THE FLUSH MOUNT WAS CONSTRUCTED:
CENTRALIZER USED ON RISER: ☒ NO ☐ YES LOCATED AT ____ — MATERIAL ☐ STAINLESS STEEL ☐ OTHER

RISER PIPE DETAILS: LENGTH 22.9 FT. — DIAMETER OF RISER PIPE 2 IN. — WEIGHT OR SDR # SCH80 — DIAMETER OF DRILL HOLE 8¼ IN. — JOINTS ☒ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER — MATERIAL ☐ STEEL ☐ OTHER ☒ THERMO PLASTIC ☐ FLUORO POLYMER

ANNULAR SEAL: ☐ CEMENT SLURRY ☒ BENTONITE SLURRY ☐ NON SLURRY BENTONITE TYPE: — ☐ CEMENT/BENTONITE SLURRY BAGS OF CEMENT USED ____ % BENTONITE USED ____ WATER USED/BAG ____ GAL.
BENTONITE SEAL: MATERIAL BENTONITE ☐ SLURRY ☒ CHIPS ☐ GRANULAR ☐ PELLETS — LENGTH OF SEAL 1.0 — BENTONITE SEAL INSTALLED IN ☒ UNSATURATED ZONE ☐ SATURATED ZONE

PRIMARY FILTER PACK: TYPE ☒ SAND ☐ MANUFACTURED ☐ NATURAL — GRAIN SIZE 16-35 — LENGTH OF FILTER PACK 80 FT. — METHOD OF INSTALLATION H.S.A. POUR
SECONDARY FILTER PACK: TYPE ☒ SAND ☐ MANUFACTURED ☐ NONE — GRAIN SIZE 100 — LENGTH OF FILTER PACK 1.0 FT. — METHOD OF INSTALLATION H.S.A. POUR
WELL SCREEN: LENGTH OF SCREEN 5 FT. — DIAMETER 2 IN. — SLOT SIZE 10 — WEIGHT OR SDR # SCH80 — MATERIAL ☒ PLASTIC ☐ STEEL ☐ FLUORO POLYMER
SUMP DETAILS: LENGTH OF SUMP — DIAMETER OF SUMP — MATERIAL ☐ PVC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER
BACK FILL: WAS THE WELL BACK FILLED? ☐ YES ☒ NO — MATERIAL USED — LENGTH OF BACK FILLED BORE HOLE

Information in this column to be supplied in the Feet from Surface column	FEET FROM SURFACE
Depth to bottom of Protective Casing Seal:	3.0
Depth to Base of Annular Seal:	16.0
Depth to Base of Bentonite Seal:	17.0
Depth to Top of Primary Filter Pack:	18.0
Depth to Top of the Screen:	21.0
Depth to Bottom of the Screen:	26.0
Total Depth:	26.0

FORMATION DESCRIPTION:
0-6 Clayey silt
6-25.5 Trash
25.5-28 Clay

STATIC WATER LEVEL ____ FEET FROM MEASURING POINT
DATE OF STATIC WATER LEVEL
MEASURING POINT FOR STATIC WATER LEVEL IS: ☒ TOP OF RISER PIPE ☐ OTHER
ELEVATION OF MEASURING POINT: 469.12
MULTIPLE CASED WELLS: SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.
DRILLING EQUIPMENT: ☐ AIR ROTARY ☒ AUGER TYPE 4¼ H.S.A. ☐ REVERSE ROTARY ☐ OTHER
DATE WELL DRILLING WAS COMPLETED: 10-04-95

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE PRIMARY CONTRACTOR/PERMIT #: Lorman D. Mahurin Jr. — DATE: 11-15-95
SIGNATURE DRILLER/PERMIT #: Lorman D. Mahurin Jr. — DATE: 11-15-95

MO 780-1415 (7-95)
DISTRIBUTION: WHITE/DIVISION CANARY/MONITORING WELL CONTRACTOR PINK/OWNER
MAIL WHITE COPY TO: DEPARTMENT OF NATURAL RESOURCES, P.O. BOX 250, ROLLA, MO 65402
ENCLOSE $35 PER MONITORING WELL FOR THE CERTIFICATION FEE WITHIN 60 DAYS AFTER WELL COMPLETION

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

DATUM NORTHING: 1068402.25 EASTING: 514718.41 ELEVATION 500.2

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD: SPLIT SPOON: 3.0 inch O.D./2 13/16 inch I.D. (SP); SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

BORING NO. LR-101

SHEET 1 OF 4

					DRILLING START	DRILLING FINISH
WATER LEVEL	DRY	51.0 FT.			TIME	TIME
TIME	11:15	15:30			8:00	15:20
DATE	10/10/95	10/10/95			DATE	DATE
CASING DEPTH	35.0 FT.	55.0 FT.			10/10/95	10/10/95

DRILL RIG CME 750

SURFACE CONDITIONS

ANGLE 90° BEARING NA

SAMPLE HAMMER

DRILLING CONTR LAYNE-WESTERN

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
1	20 39 25 23	0.1' 1.0' (10%)		ST ①	(0.0-1.0 ft.) Compact, moderate yellowish brown (10YR 5/4), SILT, NR, dry, (ML), (FILL) (499.2) 1.0		
2		1.6' 2.0' (80%)		SP ②	(1.0-2.6 ft.) Crushed, LIMESTONE Gravel, (GP), (FILL) (497.6) 2.6		
3	4 8 10 6	1.1' 2.0' (55%)		SP ③	(2.6-5.0 ft.) Compact, olive gray (5Y 4/1), SILT, NR, dry, (ML), (FILL) (495.5) 4.7		
5	7 6 25 50/3	1.0' 2.0' (50%)		SP ④	(4.7-12.4 ft.) WASTE, damp		
7	6 7 11 5	0.9' 2.0' (45%)		SP ⑤			0.0 ppm PID
9	40 8 5 14	1.1' 2.0' (55%)		SP ⑥	@ 10.0 ft., moist		
11	12 15 5 7	1.3' 2.0' (65%)		SP ⑦	(487.8) 12.4		
13	8 16 10 15			SP ⑧	(12.4-19.9 ft.) Compact, olive gray (5Y 4/1), SILT, with little waste, damp, (ML), (FILL) @ 14.5 ft., wet		

LOGGED BY B. HARRINGTON

DATE 10/23/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR101

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068402.25
DATUM EASTING: 514718.41 ELEVATION 500.2

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 3.0 inch O.D./2 13/16 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

BORING NO. LR-101

SHEET 2 OF 4

					DRILLING START	DRILLING FINISH
WATER LEVEL	DRY	51.0 FT.				
TIME	11:15	15:30			8:00	15:20
DATE	10/10/95	10/10/95			DATE 10/10/95	DATE 10/10/95
CASING DEPTH	35.0 FT.	55.0 FT.				

DRILL RIG CME 750
ANGLE 90° BEARING NA
SAMPLE HAMMER
SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
16	6 13 20 50/5	1.7'/2.0' (85%)			(12.4-19.9 ft.) Compact, olive gray (5Y 4/1), SILT, with little waste, damp, (ML), (FILL)	SP 9	
17	22 18	0.6'/2.0' (30%)					0.0 ppm PID
18	18 16					SP 10	
19	5 8	0.9'/2.0' (45%)					
20	26 10				(480.3) 19.9 (19.9-51.5 ft.) WASTE, damp	SP 11	
21	4 7	0.9'/2.0' (45%)					
22	50 25				from 21.4-21.5 ft., layer of olive gray (5Y 4/1), SILT, with little waste, wet	SP 12	
23	29 18	1.4'/2.0' (70%)					0.0 ppm PID
24	25 50/4				from 23.5-24.0 ft., layer of olive gray (5Y 4/1), SILT, with little waste, wet, (ML) @ 24.0 ft., moist	SP 13	
25	27 19	0.5'/2.0' (25%)					
26	38 38				@ 26.0 ft., wet	SP 14	
27	8 15	0.8'/2.0' (40%)					0.0 ppm PID
28	50/6					SP 15	
29	50/1	0.1'/2.0' (5%)				SP 16	

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/23/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR101

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068402.25
DATUM EASTING: 514718.41 ELEVATION 500.2

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 3.0 inch O.D./2 13/16 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

BORING NO. LR-101

SHEET 3 OF 4

					DRILLING START	DRILLING FINISH
WATER LEVEL	DRY	51.0 FT.			TIME	TIME
TIME	11:15	15:30			8:00	15:20
DATE	10/10/95	10/10/95			DATE	DATE
CASING DEPTH	35.0 FT.	55.0 FT.			10/10/95	10/10/95

DRILL RIG CME 750
ANGLE 90° BEARING NA
SAMPLE HAMMER
SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
31	50/5	0.2'/2.0' (10%)			(19.5-51.5 ft.) WASTE, damp	SP (18)	Rods warm upon withdrawal from borehole.
32						SP (17)	
33	9 23 10 16	1.5'/2.0' (75%)				SP (18)	0.0 ppm PID
34							
35	9 11 17 17	1.8'/2.0' (90%)			from 35.3-35.7 ft., layer of olive gray (5Y 4/1), SILT, moist, (ML)	SP (19)	@ 11:00 Rain
36							
37	9 38 29 17				@ 37.0 ft., wet	SP (20)	1.1 ppm PID 34% LEL, stop drilling temporarily
38							
39	42 45 36 17	1.3'/2.0' (65%)				SP (21)	
40					@ 40.0 ft., moist		
41	11 11 18 20	1.1'/2.0' (55%)				SP (22)	
42							
43	12 18 40 50/1	1.6'/2.0' (80%)				SP (23)	6.1 ppm PID
44							

DRILLING CONTR LAYNE-WESTERN
LOGGED BY B. HARRINGTON
DATE 10/23/95 CHK'D BY B. TILTON
JOB NO.: 943-2848
FILENAME: LR101

SOIL BOREHOLE LOG

LAIDLAW WASTE SYSTEMS INC.

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068402.25
DATUM EASTING: 514718.41 ELEVATION 500.2

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 3.0 inch O.D./2 13/16 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

BORING NO. LR-101

SHEET 4 OF 4

					DRILLING START	DRILLING FINISH
WATER LEVEL	DRY	51.0 FT.			TIME	TIME
TIME	11:15	15:30			8:00	15:20
DATE	10/10/95	10/10/95			DATE	DATE
CASING DEPTH	35.0 FT.	55.0 FT.			10/10/95	10/10/95

DRILL RIG CME 750
ANGLE 90° BEARING NA
SAMPLE HAMMER
SURFACE CONDITIONS

DRILLING CONTR LAYNE-WESTERN
LOGGED BY B. HARRINGTON
DATE 10/23/95 CHK'D BY B. TILTON
JOB NO.: 943-2848
FILENAME: LR101

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
46	50/5	0.5'/2.0' (25%)			(19.5-51.5 ft.) WASTE, damp	SP (24)	Drill rods very warm upon withdrawal from borehole.
47	34	1.8'/2.0' (90%)			from 47.0-48.0 ft, ammonia odor	SP (25)	
48	15 25 33						
49	12	1.9'/2.0' (95%)				SP (26)	
50	11 14 16						Newsprint dated 1974-1976 0.3 ppm PID 34% LEL Temporarily stop drilling
51	5	2.0'/2.0' (100%)			(448.7) 51.5	SP (27)	
52	13 55 50/5				(51.5-52.1 ft.) Compact, olive gray (5Y 4/1), SILT, moist, (ML), (FILL) (448.1) 52.1		
53	29	1.6'/2.0' (80%)			(52.1-54.7 ft.) Dense, black stained SILT and mixed WASTE, some Gravel (looks as if burned), damp to moist, (FILL)	SP (28)	0.0 ppm PID
54	25 6 10				(445.5) 54.7		
55	1	2.0'/2.0' (100%)			(54.7-57.0 ft.) Very loose, very light gray (N8), very fine SAND and thinly laminated lime, appears to be mine spoils, WR, wet, (FILL)	SP (29)	Water level began to rise rapidly after penetrating mine spoils.
56	1 1 3						
57					(443.2) 57.0		
58					End of Soil Borehole Log at 55.0 ft. At completion of drilling, borehole sealed to surface with cement/bentonite grout.		
59							

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

REGISTRATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF. NO. 131862	
ROUTE	P.W.S. NUMBER / CHECK NUMBER
STATE WELL NUMBER	TRANSMITTAL NO.
CHECKED BY	CROSS REFERENCE NO.
APPROVED BY / DATE	ENTERED Ph 1 Ph 2 Ph 3

INFORMATION SUPPLIED BY OWNER

NAME: LAIDLAW WASTE SYSTEMS, INC. — TELEPHONE: 314-241-3710

ADDRESS: 138 N BROADWAY — CITY: ST. LOUIS — STATE: MO — ZIP CODE: 63102

SITE NAME: LAIDLAW SANITARY LANDFILL — WELL NUMBER: LR-101 — ADDRESS OF WELL SITE OR SITE NAME (IF DIFFERENT THAN ABOVE): ST. CHARLES ROCK RD

OWNER STATUS: ☐ BUILDER ☐ PRIVATE HOME OWNER ☐ DEVELOPER ☑ OTHER (SPECIFY) LANDFILL — CITY: BRIDGETON — STATE: MO — ZIP CODE: 63044

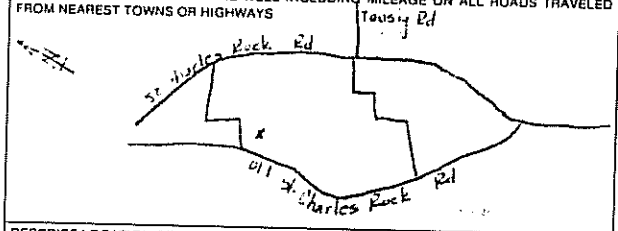
PURPOSE OF REGISTRATION FORM: ☐ ABANDONED WELL ☐ MINERAL EXPLORATORY ☐ WELL RECONSTRUCTION ☐ TEST HOLE ☑ OTHER ABANDONED PIEZOMETER

VARIANCE ISSUED? ☐ YES ☒ NO — VARIANCE NUMBER: — WELL CERTIFICATION NUMBER: — DATE ORIGINALLY DRILLED: 10-6-15

SIGNATURE (WELL OWNER) — DATE

INFORMATION SUPPLIED BY CONTRACTOR

SKETCH THE LOCATION TO THE WELL INCLUDING MILEAGE ON ALL ROADS TRAVELED FROM NEAREST TOWNS OR HIGHWAYS



LOCATION OF WELL

SHOW LOCATION IN SECTION PLAT — QUAD: — COUNTY: ST. LOUIS — ELEV: — AREA NO.:

SMALLEST ¼ — LARGEST ¼

SEC. — TWN. 47 — N,RNG. 5S — E OR W

LAT. 38 ° 46 ' 02 " LONG. 90 ° 26 ' 53 "

DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT THE WELL

775' NORTH OF SOUTHWEST FENCE CORNER AND 390' EAST OF FENCE

HOLE WAS DRILLED AND THEN ABANDONED BEFORE WELL WAS ACTUALLY SET

CONTRACTOR'S NAME: LANNE WESTERN CO, INC. — PERMIT NUMBER: 01259 — DRILLERS NAME: DALE MAHURIN — PERMIT NUMBER: 01259 WPM

ABANDONMENT OF WELLS

FORMER USE OF WELL: ☐ HAND DUG ☐ SOIL BORING ☐ DOMESTIC (1 TO 3 CONNECTIONS) ☐ PUBLIC WATER SUPPLY ☐ MULTI-FAMILY ☐ MINERAL EXPLORATORY TEST HOLE ☐ HEAT PUMP ☒ MONITORING ☐ IRRIGATION ☐ OTHER

ORIGINAL DRILLER (IF KNOWN): DALE MAHURIN — DATE ORIGINALLY DRILLED: 10-10-15

DATE PLUGGED: 10-10-15 — STATIC WATER LEVEL: FT — PUMP REMOVED FROM WELL? ☐ YES N/A ☐ NO

DEPTH OF THE WELL: 35' — LENGTH OF CASING: N/A — CASING DIAMETER/WELL DIA: 8 1/4"

GROUT INSTALLATION METHOD: ☐ GRAVITY ☑ TREMIE — CASING CUT OFF THREE FEET BELOW SURFACE? ☒ YES ☐ NO N/A — TYPE OF CASING: ☐ STEEL ☐ PLASTIC ☐ OTHER N/A

GROUT MATERIAL USED: NEAT CEMENT ☐ HI-EARLY ☒ PORTLAND TYPE 1 ☐ OTHER — ☒ BENTONITE SLURRY ☐ OTHER — BENTONITE ☒ POWDER ☐ GRANULAR ☐ CHIPS ☐ PELLETS — NUMBER OF BAGS OF GROUT USED: 20.5 — POUNDS OF GROUT PER BAG: 47

IF NEAT CEMENT USED, HOW MANY GALLONS OF WATER MIXED PER BAG OF CEMENT: 5

TYPE OF FILL MATERIAL USED: CEMENT / BENTONITE GROUT

AMOUNT OF FILL MATERIAL USED: 0.75 CU. YDS.

DEPTH TO TOP OF FILL MATERIAL: 3'

WELL DISINFECTED BEFORE PLUGGING? ☐ YES ☒ NO — NUMBER USED FOR DISINFECTION: GALLONS OF CHLORINE — POUNDS OF CHLORINE — TABLETS OF CHLORINE

WAS THE WELL ABANDONED BECAUSE OF HOOKING UP TO A PUBLIC OR RURAL WATER SUPPLY DISTRICT? ☐ YES ☒ NO

IF YES, WHAT IS THE NAME OF THE WATER DISTRICT:

CHECK THE BOX WHICH APPLIES

☒ I HEREBY CERTIFY THAT THE WELL HEREIN DESCRIBED WAS ABANDONED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE ABANDONMENT OF WELLS.

☐ I HEREBY CERTIFY THAT THE WELL HEREIN DESCRIBED WAS REPAIRED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE REPAIR OF WELLS.

CONTRACTOR'S SIGNATURE — DATE: 11-15-15

WELL RECONSTRUCTION

TYPE OF REPAIR: ☐ RAISED CASING ☐ LINING OF WELL ☐ DEEPENING OF WELL ☐ OTHER

USE OF WELL: ☐ DOMESTIC (1 TO 3 CONNECTIONS) ☐ PUBLIC WATER SUPPLY ☐ MULTI-FAMILY ☐ MONITORING ☐ HEAT PUMP ☐ OTHER ☐ IRRIGATION

DIA. OF WELL CASING IN. — WAS WELL DISINFECTED AFTER RECONSTRUCTION ☐ YES ☐ NO — DATE RECONSTRUCTION COMPLETED

RAISED CASING INFORMATION: LENGTH OF CASING ADDED FT. — MATERIAL: ☐ STEEL ☐ PLASTIC — METHOD OF ATTACHMENT: ☐ THREADED ☐ FUSED ☐ WELDED ☐ GLUED ☐ COUPLED

LINER DETAILS: PURPOSE OF LINER: ☐ USED ONLY TO HOLD BACK FORMATION ☐ USED TO SEAL OUT CONTAMINATION OR OTHER CONDITIONS — DIAMETER OF LINER IN. — WEIGHT OR SDR #

DEPTH TO THE TOP OF LINER FROM SURFACE FT. — MATERIAL: ☐ PLASTIC ☐ STEEL

AMOUNT OF LINER USED FT. — JOINTS: ☐ GLUED ☐ WELDED ☐ OTHER

LINER PACKER DETAILS: TYPE USED ☐ NONE ☐ RUBBER BOOT — DEPTH(S) SET

LINER GROUT DETAILS: POSITION OF SEAL ☐ FULL LENGTH ☐ BETWEEN PACKERS — MATERIAL: CEMENT: ☐ PORTLAND TYPE 1 ☐ HI EARLY BENTONITE: ☐ CHIPS ☐ PELLETS ☐ SLURRY ☐ GRANULAR

DEPTH PUMP WAS SET FT. GPM — DEPTH FROM SURFACE TO TOP OF THE GROUT SEAL FT. — DEPTH FROM SURFACE TO BOTTOM OF THE GROUT SEAL FT.

DEEPENING OF WELL INFORMATION

DEPTH FROM	DEPTH TO	FORMATION DESCRIPTION	YIELD

MO 780-1414 (1-95)

DISTRIBUTION: WHITE/CONTRACTOR CANARY/DIVISION PINK/OWNER

MAIL CANARY COPY TO: DEPARTMENT OF NATURAL RESOURCES, P.O. BOX 250, ROLLA, MO 65401 RECORD MUST BE SUBMITTED WITHIN 60 DAYS OF COMPLETION DATE

SOIL BOREHOLE LOG

LAIDLAW WASTE SYSTEMS INC.

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068937.21
DATUM EASTING: 514788.13 ELEVATION 512.0

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 3.0 inch O.D./2 13/16 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

BORING NO. LR-102

SHEET 1 OF 6

		DRILLING START	DRILLING FINISH
WATER LEVEL	54.0 FT.	TIME	TIME
TIME	10:15	11:55	14:30
DATE	10/8/95	DATE	DATE
CASING DEPTH	60.0 FT.	10/6/95	10/7/95

DRILL RIG CME 750
ANGLE 90° BEARING NA
SAMPLE HAMMER

SURFACE CONDITIONS

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON
DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848
FILENAME: LR102

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
1		1.5'/2.0' (75%)			(0.0-1.5 ft.) Compact, moderate yellowish brown (10YR 5/4), SILT, NR, dry, (ML), (FILL)	ST 1	
					(510.5) 1.5		
2	50/3	0.3'/2.0' (15%)			(1.5-19.5 ft.) WASTE, consisting of wood, asphalt, carpet and other demolition wastes intermixed with olive black composite soil	SP 2	Petroleum odor
3							
4	15	1.1'/2.0' (55%)					0.0 ppm PID
5	17 5 6					SP 3	
6	9 22	0.5'/2.0' (25%)					
7	22 4					SP 4	
8	3 50/6	0.8'/2.0' (40%)			from 8.4-8.8 ft, layer of dark gray SILT with gravel sized stones		0.3 ppm PID
9						SP 5	
10	11	0.7'/2.0' (35%)			@ 10.5 ft, asphalt		
11	50/3					SP 6	
12	50/6	0.5'/2.0' (25%)			from 12.0-14.2 ft, carpet		0.9 ppm PID
13						SP 7	
14	15 50/6	0.7'/2.0' (35%)				SP 8	

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	LAIDLAW/OU2 RI-FS/MQ WEST LAKE LANDFILL OPERABLE UNIT 2
DRILLING METHOD:	4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger
SAMPLING METHOD:	SPLIT SPOON: 3.0 inch O.D./2 13/16 inch I.D. (SP) SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)
BORING NO.	LR-102
SHEET	2 OF 6
WATER LEVEL	54.0 FT.
TIME	10:15
DATE	10/8/95
CASING DEPTH	60.0 FT.
DRILLING START TIME	11:55
DRILLING FINISH TIME	14:30
DRILLING START DATE	10/6/95
DRILLING FINISH DATE	10/7/95
DATUM	NORTHING: 1068937.21 EASTING: 514788.13
ELEVATION	512.0
DRILL RIG	CME 750
SURFACE CONDITIONS	
ANGLE	90°
BEARING	NA
SAMPLE HAMMER	

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
16	50/4	0.0'/2.0' (0%)			(1.5-19.5 ft.) Compacted, WASTE, consisting of wood, asphalt, carpet and other demolition wastes intermixed with olive black composite soil	SP 8	0.1 ppm PID
17						SP 9	
18	16 20 24	0.3'/2.0' (15%)				SP 10	
19	11				(492.5) 19.5		
20	10 8	0.8'/2.0' (40%)			(19.5-20.5 ft.) Compact, greenish gray (5GY 6/1), SILT, damp, (ML), (FILL) (491.5) 20.5		0.1 ppm PID
21	8 5				(20.5-36.0 ft.) WASTE, municipal intermixed with medium gray SILT, moist, strong leachate odor	SP 11	
22	0 0	0.2'/2.0' (10%)			@ 22.0 ft., wet	SP 12	
23	13 33						
24	28 50/4	0.0'/2.0' (0%)				SP 13	0.7 ppm PID
25					@ 25.0 ft., moist		
26	0 0	0.4'/2.0' (20%)				SP 14	
27	8 6						
28	50/3	0.3'/2.0' (15%)				SP 15	0.0 ppm PID
29							

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR102

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068937.21
DATUM EASTING: 514788.13 ELEVATION 512.0

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 3.0 inch O.D./2 13/16 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

WATER LEVEL	54.0 FT.				
TIME	10:15				
DATE	10/8/95				
CASING DEPTH	60.0 FT.				

BORING NO. LR-102

SHEET 3 OF 6

DRILLING: START TIME 11:55, DATE 10/6/95; FINISH TIME 14:30, DATE 10/7/95

DRILL RIG CME 750

ANGLE 90° BEARING NA

SAMPLE HAMMER

SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
31	14 50/5	0.0' 2.0' <0%>			(20.5-36.0 ft.) Compacted WASTE, municipal intermixed with medium gray SILT, moist, strong leachate odor	SP (16)	
32	32 33 20	0.0' 2.0' <0%>				SP (17)	1.2 ppm PID
33	12						
34	13 9	0.2' 2.0'				SP (18)	
35	10 50/4	<10%>					1.1 ppm PID
36	50/5	0.0' 2.0' <0%>			(36.0-48.4 ft.) WASTE, demolition and construction debris, aphalt, particle board, wood, corrugated cardboard, brick, etc, intermixed with black composite soil, moist	SP (19)	
37							
38	41 50/3	0.4' 2.0'				SP (20)	
39		<20%>					
40	20 50/1	0.2' 2.0'				SP (21)	0.2 ppm PID
41		<10%>					
42	27 13	0.6' 2.0'				SP (22)	
43	25 24	<30%>					
44	50/5	0.0' 2.0' <0%>				SP (23)	1.0 ppm PID

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR102

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD:					BORING NO.
	4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger					LR-102
						SHEET 4 OF 6
	SAMPLING METHOD:					
LAIDLAW/OU2 RI-FS/MO WEST LAKE LANDFILL OPERABLE UNIT 2	SPLIT SPOON: 3.0 inch O.D./2 13/16 inch I.D. (SP)					DRILLING
	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)					START / FINISH
	WATER LEVEL	54.0 FT.				TIME / TIME
	TIME	10:15				11:55 / 14:30
	DATE	10/8/95				DATE / DATE
NORTHING: 1068937.21 DATUM EASTING: 514788.13 ELEVATION 512.0	CASING DEPTH	60.0 FT.				10/6/95 / 10/7/95

DRILL RIG CME 750 | SURFACE CONDITIONS

ANGLE 90° BEARING NA

SAMPLE HAMMER

DEPTH IN FEET (ELEVATION)	BLOW/6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
46	6 17 15 16	1.8'/2.0' (90%)			(36.0-48.4 ft.) Compacted WASTE, demolition and construction debris, asphalt, particle board, wood, corrugated cardboard, brick, etc., intermixed with black composite soil, moist from 45.0-45.5 ft., layer of compact, medium gray (N5), SILT, some Gravel, moist, (ML), (FILL)	SP 23	
47						SP 24	
48	7 18 27 17	2.0'/2.0' (100%)			(463.6) 48.4 (48.4-50.8 ft.) Dense, olive gray (5Y 4/1), SILT, with little waste and demolition debris, moist, (ML), (FILL)	SP 25	1.1 ppm PID
49							
50	7 9 10 12	1.6'/2.0' (80%)			(461.2) 50.8 (50.8-58.0 ft.) WASTE, demolition debris, bricks, wood, etc., with little olive gray Silt, moist	SP 26	
51							
52	8 11 50/5	1.5'/2.0' (75%)				SP 27	
53					@ 53.0 ft., wet		
54	10 14 50/4	1.1'/2.0' (55%)				SP 28	
55							
56	14 16 16 18	1.2'/2.0' (60%)				SP 29	0.7 ppm PID
57							
58	3 50/6	0.6'/2.0' (30%)			(454.0) 58.0 (58.0-62.8 ft.) Compact, olive gray (5Y 4/1), SILT and GRAVEL, wet, (ML/GP), (FILL)	SP 30	
59							0.2 ppm PID

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR102

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MD
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068937.21
DATUM EASTING: 514788.13 ELEVATION 512.0

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 3.0 inch O.D./2 13/16 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

WATER LEVEL	54.0 FT.				
TIME	10:15				
DATE	10/8/95				
CASING DEPTH	60.0 FT.				

BORING NO. LR-102

SHEET 5 OF 6

DRILLING: START TIME 11:55 DATE 10/6/95; FINISH TIME 14:30 DATE 10/7/95

DRILL RIG CME 750

ANGLE 90° BEARING NA

SAMPLE HAMMER

SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
61	13 19 9 14	2.0'/2.0' (100%)			(58.0-62.8 ft.) Compact, olive gray (5Y 4/1), SILT and GRAVEL, wet, (ML/GP), (FILL)	SP (31)	
62	13 33 32	1.4'/2.0' (70%)			(449.2) 62.8	SP (32)	
63	35				(62.8-76.0 ft.) WASTE, demolition debris that appears to have been burned, wet to moist, with some olive gray Silt		
64	8 40 50/5	1.1'/2.0' (55%)			below 64.0 ft., waste becomes moist to damp	SP (33)	0.1 ppm PID
65							
66	65 49 25	0.5'/2.0' (25%)				SP (34)	
67	50/1						
68	8 29 21	0.4'/2.0' (20%)				SP (35)	0.0 ppm PID
69	12						
70	4 9 12	0.6'/2.0' (30%)				SP (36)	
71	27						
72	28 17 30	1.2'/2.0' (60%)				SP (37)	0.1 ppm PID
73	50/5						
74	50/2	0.0'/2.0' (0%)				SP (38)	0.7 ppm PID

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR102

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068937.21
DATUM EASTING: 514788.13 ELEVATION 512.0

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD: SPLIT SPOON: 3.0 inch O.D./2 13/16 inch I.D. (SP); SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

BORING NO. LR-102

SHEET 6 OF 6

					DRILLING START	DRILLING FINISH
WATER LEVEL	54.0 FT.				TIME 11:55	TIME 14:30
TIME	10:15					
DATE	10/8/95				DATE 10/6/95	DATE 10/7/95
CASING DEPTH	60.0 FT.					

DRILL RIG CME 750

ANGLE 90° BEARING NA

SAMPLE HAMMER

SURFACE CONDITIONS

DRILLING CONTR LAYNE-WESTERN

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
76			▽ ▽ ▽ ▽ ▽ ▽		(62.8-76.0 ft.) Compacted WASTE, demolition debris, moist to damp, with some olive gray Silt (436.0) 76.0	SP (38)	
					End of Soil Borehole Log at 76.0 ft.		
77							
78							
79							
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR102

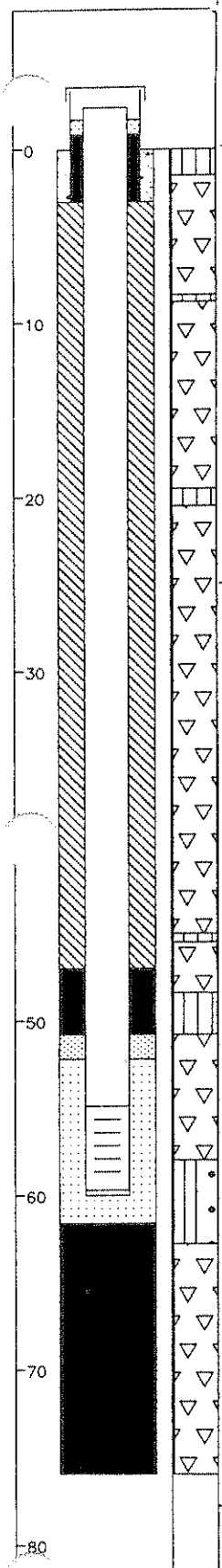
Well No. LR-102

Boring No. X-Ref: LR-102

PIEZOMETER CONSTRUCTION SUMMARY

Survey Coords: Northing: 1068937 ft.
Easting: 514788 ft.

Elevation Ground Level 512.0 ft. NGVD
Top of PVC Casing 513.52 ft. NGVD



Drilling Summary:

Total Depth 76.0 ft.
Borehole Diameter 8 1/4" (0.0-76.0')
Casing Stickup Height 1.52 ft.
Driller Layne-Western
St. Louis, MO

Rig CME 750
Bit(s) 4 1/4" ID Hollow Stem Auger Bit

Drilling Fluid None

Protective Casing 8x8" Square Steel, by 5' long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
CME 750	10/6/95	11:55	10/7/95	14:30
Geophys.Logging:				
Casing:				
2" I.D. PVC	10/8/95	14:30	10/8/95	15:05
Filter Placement:	10/8/95	12:50	10/8/95	15:45
Cementing:				
Development				
Bentonite Grout	10/8/95	16:20	10/8/95	
Bentonite Seal	10/8/95	15:45	10/8/95	15:55

Well Design & Specifications

Basis: Geologic Log X Geophysical Log

Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 1.52	-	54.90	C1	513.52	-	457.10
54.90	-	59.70	S1	457.10	-	452.30
59.70	-	60.00	C2	452.30	-	452.00
	-				-	
	-				-	
	-				-	

Casing: C1 2" dia. Schedule 80 PVC, flush threaded with O-rings
C2 2" dia. threaded PVC end cap (4" long or 0.33')

Screen: S1 2" dia. Schedule 80 PVC, 0.010" machine cut slot, flush threaded with O-rings

Sand Pack: 16-35 mesh Silica Sand 52.2-61.6'

Filter Pack: Less than 50 mesh Silica Sand 50.8-52.2'

Grout Seal: Wyo-Ben Grout Well Bentonite Slurry 3.0-47.0'

Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry 47.0-50.8', Chips 61.6-76.0'

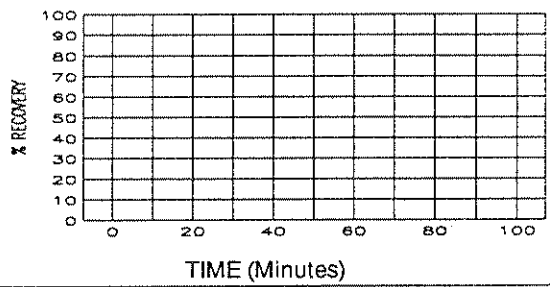
Concrete: 0.0-3.0'

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments:

Not to Scale

Supervised by B. Harrington
Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO
File Name LR102

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF. NO. 145106	
C.R. NO.	CHECK NO.
STATE WELL NUMBER	TRANSMITTAL NO.
CHECKED BY	ROUTE
APPROVED BY	ENTERED Ph 1 Ph 2 Ph 3

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

SITE/FACILITY NAME: LAIDLAW BRIDGETON SANITARY LANDFILL
WELL NUMBER: LR-102
SITE ADDRESS: ST. CHARLES ROCK RD
CITY: BRIDGETON
STATE: Mo
ZIP CODE: 63044
OWNER NAME: LAIDLAW WASTE SYSTEMS, INC.
TELEPHONE: 314-241-3710
OWNER ADDRESS: 1838 N. BROADWAY
CITY: ST. LOUIS
STATE: Mo
ZIP CODE: 63102

VARIANCE ISSUED ☐ YES ☒ NO
DATE ISSUED:
VARIANCE NUMBER: V

DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT
WEST SIDE OF SITE, 390' EAST OF FENCE LINE AND 1550' NORTH OF SOUTHWEST FENCE CORNER. (ON TOP OF HILL)

LOCATION OF WELL
SHOW LOCATION IN SECTION PLAT
COUNTY: ST. LOUIS
SURFACE ELEVATION: 512.0
SMALLEST ¼ ____ ¼ ____ ¼ LARGEST ¼ ____ ¼
SEC. ____ TWN. 47 N,RNG. 5 (E OR W)
LAT. 38 ° 46 ' 09 " LONG. 90 ° 26 ' 53 "

MONITORING WELL INSTALLATION CONTRACTOR'S NAME: LAYNE WESTERN CO, INC. PERMIT NUMBER: 001258 WPM
DRILLING CONTRACTOR'S NAME: LAYNE WESTERN CO, INC. PERMIT NUMBER: 001258 WPM

WELL CONSTRUCTION INFORMATION

TYPE OF WELL: ☐ MONITORING WELL ☒ PIEZOMETER ☐ OTHER
TYPE OF POTENTIAL SITE: ☐ HAZARDOUS MATERIAL ☒ LANDFILL ☐ OTHER ☐ L.U.S.T.
MONITORING FOR: (CHECK ALL THAT APPLY) ☒ V.O.C. ☐ METALS ☐ PETROLEUM PRODUCT ☐ OTHER ONLY

PROTECTIVE CASING DETAILS (IF USED): LENGTH 5 FT. | DIAMETER OF CASING 8x8 IN. | WEIGHT OR SDR # 0.188" | DIAMETER AND DEPTH OF DRILL HOLE 8¼ IN. 76 FT. | JOINTS ☐ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER | MATERIAL ☐ THERMO PLASTIC ☒ STEEL ☐ FLUORO POLYMER TYPE | LOCKING CAP? ☒ YES ☐ NO

CAP VENTED ☒ YES ☐ NO
WEEP HOLE? ☒ YES ☐ NO
CASING GROUT DETAILS: MATERIAL ☐ CEMENT ☒ CONCRETE ☐ OTHER | DEPTH FROM THE SURFACE TO THE BOTTOM OF THE CASING GROUT SEAL 3.0 FT. | TYPE OF SURFACE COMPLETION ☒ ABOVE GROUND ☐ FLUSH MOUNT
DESCRIBE HOW THE FLUSH MOUNT WAS CONSTRUCTED

CENTRALIZER USED ON RISER ☒ NO ☐ YES LOCATED AT | MATERIAL ☐ STAINLESS STEEL ☐ OTHER

RISER PIPE DETAILS: LENGTH 56.5 FT. | DIAMETER OF RISER PIPE 2 IN. | WEIGHT OR SDR # SCH 80 | DIAMETER OF DRILL HOLE 8¼ IN. | JOINTS ☒ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER | MATERIAL ☒ THERMO PLASTIC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER

ANNULAR SEAL: ☐ CEMENT SLURRY ☒ BENTONITE SLURRY ☐ NON SLURRY BENTONITE ☐ CEMENT/BENTONITE SLURRY BAGS OF CEMENT USED ____ % BENTONITE USED ____ WATER USED/BAG ____ GAL. TYPE: ____

BENTONITE SEAL: MATERIAL BENTONITE ☒ SLURRY ☐ CHIPS ☐ GRANULAR ☐ PELLETS | LENGTH OF SEAL 3.8 | BENTONITE SEAL INSTALLED IN ☒ UNSATURATED ZONE ☐ SATURATED ZONE

PRIMARY FILTER PACK: TYPE ☒ SAND ☐ MANUFACTURED ☐ NATURAL | GRAIN SIZE 16-35 | LENGTH OF FILTER PACK 9.4 FT. | METHOD OF INSTALLATION H.S.A. POUR

SECONDARY FILTER PACK: TYPE ☒ SAND ☐ MANUFACTURED ☐ NONE | GRAIN SIZE 100 | LENGTH OF FILTER PACK 1.4 FT. | METHOD OF INSTALLATION H.S.A. POUR

WELL SCREEN: LENGTH OF SCREEN 5 FT. | DIAMETER 2 IN. | SLOT SIZE 10 | WEIGHT OR SDR # SCH 80 | MATERIAL ☒ PLASTIC ☐ STEEL ☐ FLUORO POLYMER

SUMP DETAILS: LENGTH OF SUMP | DIAMETER OF SUMP | MATERIAL ☐ PVC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER

BACK FILL: WAS THE WELL BACK FILLED? ☒ YES ☐ NO | MATERIAL USED MED. BENT. CHIPS | LENGTH OF BACK FILLED BORE HOLE 14.4'

Information in this column to be supplied in the Feet from Surface column	FEET FROM SURFACE	FORMATION DESCRIPTION
Depth to bottom of Protective Casing Seal:	3.0	0-1.5 Clayey silt 1.5-76 Trash
Depth to Base of Annular Seal:	47.0	
Depth to Base of Bentonite Seal:	50.8	
Depth to Top of Primary Filter Pack:	52.2	
Depth to Top of the Screen:	55.0	
Depth to Bottom of the Screen:	60.0	
Total Depth:	76.0	
DATE WELL DRILLING WAS COMPLETED	10-08-95	

STATIC WATER LEVEL FEET FROM MEASURING POINT
DATE OF STATIC WATER LEVEL
MEASURING POINT FOR STATIC WATER LEVEL IS ☒ TOP OF RISER PIPE ☐ OTHER
ELEVATION OF MEASURING POINT 513.52

MULTIPLE CASED WELLS
SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.

DRILLING EQUIPMENT ☐ AIR ROTARY ☒ AUGER TYPE 4¼ H.S.A. ☐ REVERSE ROTARY ☐ OTHER

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE PRIMARY CONTRACTOR/PERMIT #	DATE	SIGNATURE DRILLER/PERMIT #	DATE
Leman N. Mahurin Jr.	11-15-95	Leman N. Mahurin Jr.	11-15-95

MO 780-1415 (7-95)

DISTRIBUTION: WHITE/DIVISION CANARY/MONITORING WELL CONTRACTOR PINK/OWNER
MAIL WHITE COPY TO: DEPARTMENT OF NATURAL RESOURCES, P.O. BOX 250, ROLLA, MO 65402
ENCLOSE $35 PER MONITORING WELL FOR THE CERTIFICATION FEE WITHIN 60 DAYS AFTER WELL COMPLETION

RECYCLED PAPER

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MD
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068527.38
DATUM EASTING: 515217.07 ELEVATION 460.1

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

WATER LEVEL	26.74 FT			
TIME	9:16			
DATE	10/20/95			
CASING DEPTH	38.0 FT.			

BORING NO. LR-103

SHEET 1 OF 3

DRILLING START	DRILLING FINISH
TIME 14:00	TIME 9:00
DATE 10/19/95	DATE 10/20/95

DRILL RIG CME 750

ANGLE 90° BEARING NA

SAMPLE HAMMER

SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
1	2, 4, 6, 8	1.0'/2.0' (50%)			(0.0-2.5 Ft.) Stiff, moderate yellowish brown (10YR 5/4), CLAYEY SILT, trace fine Gravel, occasional cobbles, NR, dry, (CL-ML), (FILL)	SP 1	
2	17, 12	1.3'/2.0'			(457.6) 2.5		
3	13, 16	(65%)			(2.5-3.5 Ft.) Very stiff, medium gray (N5), SANDY SILT, little c-f Gravel, occasional cobbles, SR, damp, (ML), (FILL)	SP 2	
4	9, 10, 8, 11	0.7'/2.0' (35%)			(3.5-7.5 Ft.) Very stiff, medium bluish gray (5B 5/1), SILT, little c-f Sand, WR, damp, (ML), (FILL)	SP 3	
5							
6	3, 8, 5, 4	1.2'/2.0' (60%)				SP 4	
7							
8	3, 5, 4, 4	1.1'/2.0' (55%)			(7.5-10.0 Ft.) Stiff, medium light gray (N6), SANDY SILT, little c-f Gravel, SR, damp, (ML), (FILL)	SP 5	
9							
10	2, 2, 3, 2	1.6'/2.0' (80%)			(10.0-19.3 Ft.) Firm, medium gray (N5), SILT, little fine Sand, trace iron staining, SR, damp, (ML), (LOESS)	SP 6	
11							
12	1, 2, 3, 3	1.4'/2.0' (70%)				SP 7	@ 12.0 Ft. Hole began making gas at low levels
13							
14	2, 2, 3, 4	2.0'/2.0' (100%)				SP 8	

DRILLING CONTR LAYNE-WESTERN

LOGGED BY M. SANDFORT

DATE 10/23/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR103

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068527.38
DATUM EASTING: 515217.07 ELEVATION 460.1

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

WATER LEVEL	26.74 FT.			
TIME	9:16			
DATE	10/20/95			
CASING DEPTH	38.0 FT.			

BORING NO. LR-103

SHEET 2 OF 3

DRILLING START	DRILLING FINISH
TIME 14:00	TIME 9:00
DATE 10/19/95	DATE 10/20/95

DRILL RIG CME 750

SURFACE CONDITIONS

ANGLE 90° BEARING NA

SAMPLE HAMMER

DRILLING CONTR LAYNE-WESTERN

LOGGED BY M. SANDFORT DATE 10/23/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR103

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
16	3 3 4 5	2.0' / 2.0' (100%)			(10.0-19.3 Ft.) Firm, medium gray (N5), SILT, little Fine Sand, trace iron staining, SR, damp, (ML), (LOESS)	SP (8)	
17						SP (9)	
18	1 2 2 4	2.0' / 2.0' (100%)			From 18.0-19.0 Ft, wet zone	SP (10)	
19					(440.8) 19.3		
20	2 4 6 7	2.0' / 2.0' (100%)			(19.3-24.2 Ft.) Firm, grayish black (N2), SILTY CLAY, NR, damp, (CL), (ALLUVIUM)	SH (11)	
21							
22	2 4 5 8	2.0' / 2.0' (100%)			@ 22.3 Ft, color changes to medium dark gray (N4)	SP (12)	
23							
24	6 12 17 15	2.0' / 2.0' (100%)			(435.9) 24.2 (24.2-38.0 Ft.) Compact, medium gray to medium dark gray (N5 to N4), Fine SAND, trace Silt, NR, damp, (SP), (ALLUVIUM)	SP (13)	
25							
26	4 4 6 15	1.2' / 2.0' (60%)				SP (14)	@ 26.0 Ft, encountered water
27					From 27.2-27.5 Ft, CLAYEY SILT layer		
28	8 8 15 15	2.0' / 2.0' (100%)				SP (15)	
29							

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068527.38
DATUM EASTING: 515217.07 ELEVATION 460.1

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

WATER LEVEL	26.74 FT			
TIME	9:16			
DATE	10/20/95			
CASING DEPTH	38.0 FT.			

BORING NO. LR-103

SHEET 3 OF 3

DRILLING

START	FINISH
TIME 14:00	TIME 9:00
DATE 10/19/95	DATE 10/20/95

DRILL RIG CME 750

SURFACE CONDITIONS

ANGLE 90° BEARING NA

SAMPLE HAMMER

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
31	4 4 7 10	1.5'/2.0' (75%)			(24.2-38.0 Ft.) Compact, medium gray to medium dark gray (N5 to N4), fine SAND, trace Silt, NR, damp, (SP), (ALLUVIUM)	SP (16)	
32	5 11 14 27	1.3'/2.0' (65%)			From 32.3-32.5 Ft. layers of decayed vegetation	SP (17)	
33							
34	6 12 15 15					SP (18)	
35							
36	5 6 12 14				@ 37.0 Ft., SAND becomes medium to fine grained	SP (19)	
37					(422.1) 38.0		
38					End of Soil Borehole Log at 38.0 Ft.		
39							
40							
41							
42							
43							
44							

DRILLING CONTR LAYNE-WESTERN

LOGGED BY M. SANDFORT

DATE 10/23/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR103

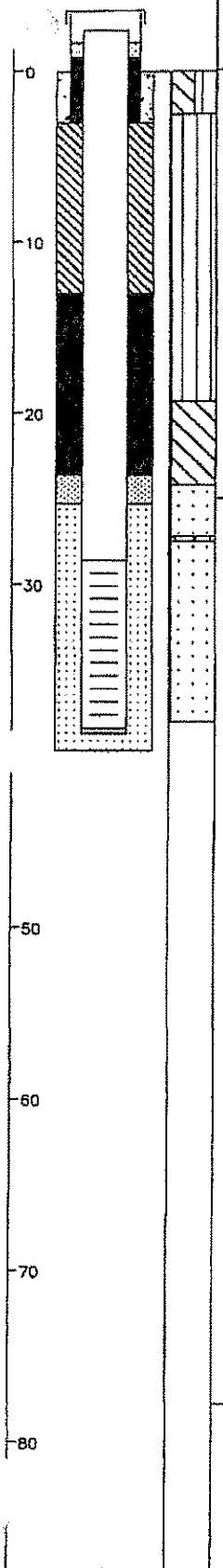
Well No. LR-103

Boring No. X-Ref: LR-103

PIEZOMETER CONSTRUCTION SUMMARY

Survey Coords: Northing: 1068527 ft.
Easting: 515217 ft.

Elevation Ground Level 460.1 ft. NGVD
Top of PVC Casing 461.28 ft. NGVD



Drilling Summary:

Total Depth 40.0 ft.
Borehole Diameter 8 1/4" (0.0-40.0')
Casing Stickup Height 1.10 ft.
Driller Layne-Western
St. Louis, MO

Rig CME 750
Bit(s) 4 1/4" ID/8 1/4" O.D. Hollow Stem Auger Bit

Drilling Fluid None

Protective Casing 8x8" Square Steel, by 5' long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
CME 75	10/19/95	14:00	10/20/95	9:00
Geophys.Logging:				
Casing:				
2" I.D. PVC	10/20/95	8:55	10/20/95	8:59
Filter Placement:	10/20/95	9:10	10/20/95	10:25
Cementing:				
Development				
Bentonite Grout	10/20/95	10:35	10/20/95	10:50
Bentonite Seal	10/20/95	10:28	10/20/95	10:35

Well Design & Specifications

Basis: Geologic Log X Geophysical Log
Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 1.10	-	28.60	C1	461.28	-	431.50
28.60	-	38.40	S1	431.50	-	421.70
38.40	-	38.70	C2	421.70	-	421.40
	-				-	
	-				-	
	-				-	

Casing: C1 2" dia. Schedule 80 PVC, flush threaded with O-rings
C2 2" dia. threaded PVC end cap (4" long or 0.33')
Screen: S1 2" dia. Schedule 80 PVC, 0.010" machine cut slot, flush threaded with O-rings

Sand Pack: 16-35 mesh Silica Sand 25.3-39.7'

Filter Pack: 100 mesh Silica Sand 23.6-25.3'

Grout Seal: Wyo-Ben Grout Well Bentonite Slurry 3.0-13.0'

Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry 13.0-23.6'

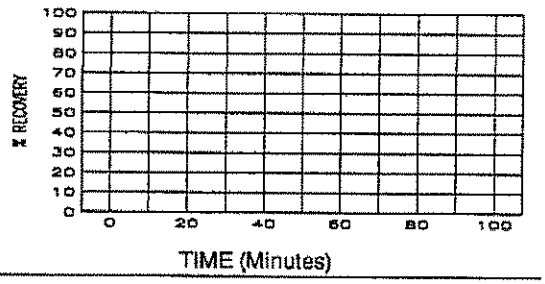
Concrete: 0.0-3.0'

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments:

Not to Scale

Supervised by M. Sandfort
Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO
File Name LR103

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF. NO. 145107	
C.R. NO.	CHECK NO.
STATE WELL NUMBER	TRANSMITTAL NO.
CHECKED BY	ROUTE
APPROVED BY	ENTERED Ph 1 Ph 2 Ph 3

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

SITE/FACILITY NAME: LAIDLAW BRIDGETON SANITARY LANDFILL
WELL NUMBER: LR-103
SITE ADDRESS: ST. CHARLES ROCK RD
CITY: BRIDGETON
STATE: Mo
ZIP CODE: 63044
OWNER NAME: LAIDLAW WASTE SYSTEMS, INC.
TELEPHONE: 314-241-3710
OWNER ADDRESS: 1838 N. BROADWAY
CITY: ST. LOUIS
STATE: MO
ZIP CODE: 63102
VARIANCE ISSUED: ☐ YES ☒ NO
DATE ISSUED:
VARIANCE NUMBER: V
DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT: AT WEST BASE OF GRAVEL PILE FOR ASPHALT PLANT.

LOCATION OF WELL
SHOW LOCATION IN SECTION PLAT
COUNTY: ST. LOUIS
SURFACE ELEVATION: 460.1
SMALLEST ¼ ____ ¼ ____ ¼ LARGEST ¼ ____ ¼
SEC. ____ TWN. 47 N,RNG. 5 ☐E ☒W
LAT. 38 ° 46 ' 05 " LONG. 90 ° 26 ' 48 "

MONITORING WELL INSTALLATION CONTRACTOR'S NAME: LAYNE WESTERN CO., INC. PERMIT NUMBER: 001258 WPM
DRILLING CONTRACTOR'S NAME: LAYNE WESTERN CO., INC. PERMIT NUMBER: 001258 WPM

WELL CONSTRUCTION INFORMATION

TYPE OF WELL: ☐ MONITORING WELL ☒ PIEZOMETER ☐ OTHER ____
TYPE OF POTENTIAL SITE: ☐ HAZARDOUS MATERIAL ☒ LANDFILL ☐ OTHER ☐ L.U.S.T. ____
MONITORING FOR: (CHECK ALL THAT APPLY) ☒ V.O.C. ☐ METALS ☐ PETROLEUM PRODUCT ☐ OTHER ____ ONLY

PROTECTIVE CASING DETAILS (IF USED): LENGTH 5 FT. | DIAMETER OF CASING 8x8 IN. | WEIGHT OR SDR # 0.188 | DIAMETER AND DEPTH OF DRILL HOLE 8¼ IN. 40 FT. | JOINTS ☐ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER ____ | MATERIAL ☒ STEEL ☐ THERMO PLASTIC ☐ FLUORO POLYMER TYPE ____ | LOCKING CAP? ☒ YES ☐ NO

CAP VENTED ☒ YES ☐ NO
WEEP HOLE? ☒ YES ☐ NO
CASING GROUT DETAILS: MATERIAL ☐ CEMENT ☒ CONCRETE ☐ OTHER ____ | DEPTH FROM THE SURFACE TO THE BOTTOM OF THE CASING GROUT SEAL 3.0 FT. | TYPE OF SURFACE COMPLETION ☒ ABOVE GROUND ☐ FLUSH MOUNT | DESCRIBE HOW THE FLUSH MOUNT WAS CONSTRUCTED

CENTRALIZER USED ON RISER ☒ NO ☐ YES LOCATED AT ____ | MATERIAL ☐ STAINLESS STEEL ☐ OTHER ____

RISER PIPE DETAILS: LENGTH 31.2 FT. | DIAMETER OF RISER PIPE 2 IN. | WEIGHT OR SDR # SCH80 | DIAMETER OF DRILL HOLE 8¼ IN. | JOINTS ☒ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER ____ | MATERIAL ☒ THERMO PLASTIC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER ____

ANNULAR SEAL: ☐ CEMENT SLURRY ☒ BENTONITE SLURRY ☐ NON SLURRY BENTONITE ☐ CEMENT/BENTONITE SLURRY TYPE: ____ BAGS OF CEMENT USED ____ % BENTONITE USED ____ WATER USED/BAG ____ GAL.
BENTONITE SEAL: MATERIAL BENTONITE ☒ SLURRY ☐ CHIPS ☐ GRANULAR ☐ PELLETS | LENGTH OF SEAL 10.6 | BENTONITE SEAL INSTALLED IN ☐ UNSATURATED ZONE ☒ SATURATED ZONE

PRIMARY FILTER PACK: TYPE ☒ SAND ☐ MANUFACTURED ☐ NATURAL | GRAIN SIZE 16-35 | LENGTH OF FILTER PACK 14.7 FT. | METHOD OF INSTALLATION H.S.A. POUR
SECONDARY FILTER PACK: TYPE ☒ SAND ☐ MANUFACTURED ☐ NONE | GRAIN SIZE 100 | LENGTH OF FILTER PACK 1.7 FT. | METHOD OF INSTALLATION H.S.A. POUR
WELL SCREEN: LENGTH OF SCREEN 10 FT. | DIAMETER 2 IN. | SLOT SIZE 10 | WEIGHT OR SDR # SCH 80 | MATERIAL ☒ PLASTIC ☐ STEEL ☐ FLUORO POLYMER
SUMP DETAILS: LENGTH OF SUMP | DIAMETER OF SUMP | MATERIAL ☐ PVC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER
BACK FILL: WAS THE WELL BACK FILLED? ☐ YES ☒ NO | MATERIAL USED | LENGTH OF BACK FILLED BORE HOLE

Information in this column to be supplied in the Feet from Surface column	FEET FROM SURFACE	FORMATION DESCRIPTION
Depth to bottom of Protective Casing Seal:	3.0	0-7 Gravelly clay
Depth to Base of Annular Seal:	13.0	7-26 Silty clay
Depth to Base of Bentonite Seal:	23.6	
Depth to Top of Primary Filter Pack:	25.3	
Depth to Top of the Screen:	30.0	26-40 Silty sand
Depth to Bottom of the Screen:	40.0	
Total Depth:	40.0	

STATIC WATER LEVEL FEET FROM MEASURING POINT: ____
DATE OF STATIC WATER LEVEL: ____
MEASURING POINT FOR STATIC WATER LEVEL IS: ☒ TOP OF RISER PIPE ☐ OTHER ____
ELEVATION OF MEASURING POINT: 461.28
MULTIPLE CASED WELLS: SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.
DRILLING EQUIPMENT: ☐ AIR ROTARY ☒ AUGER TYPE 4¼ H.S.A. ☐ REVERSE ROTARY ☐ OTHER ____
DATE WELL DRILLING WAS COMPLETED: 10-20-95

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE PRIMARY CONTRACTOR/PERMIT #: Thomas J. Mahurin Jr. | DATE: 11-15-95
SIGNATURE DRILLER/PERMIT #: Thomas J. Mahurin Jr. | DATE: 11-15-95

MO 780-1415 (7-95)
DISTRIBUTION: WHITE/DIVISION CANARY/MONITORING WELL CONTRACTOR PINK/OWNER
MAIL WHITE COPY TO: DEPARTMENT OF NATURAL RESOURCES, P.O. BOX 250, ROLLA, MO 65402
ENCLOSE $35 PER MONITORING WELL FOR THE CERTIFICATION FEE WITHIN 60 DAYS AFTER WELL COMPLETION
RECYCLED PAPER

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1067709.56
DATUM EASTING: 514524.56 ELEVATION 484.2

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

WATER LEVEL	21.3 FT.	32.0 FT.			
TIME	13:50	11:00			
DATE	10/03/95	10/04/95			
CASING DEPTH	28.0 FT.	36.0 FT.			

BORING NO. LR-105

SHEET 1 OF 3

DRILLING START TIME 9:45 DATE 10/03/95
DRILLING FINISH TIME 14:45 DATE 10/03/95

DRILL RIG CME 750
ANGLE 90° BEARING NA
SAMPLE HAMMER
SURFACE CONDITIONS

DRILLING CONTR LAYNE-WESTERN
LOGGED BY B. HARRINGTON
DATE 10/9/95 CHK'D BY B. TILTON
JOB NO.: 943-2848
FILENAME: LR105

DEPTH IN FEET (ELEVATION)	BLOW/6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
1	6 8 6 8	1.8'/2.0' (90%)			(0.0-2.2 Ft.) Compact, moderate yellowish brown (10YR 5/4), SILTY CLAY, NR, dry, (CL), (FILL) @ 1.3 ft, damp	SP 1	
2					(482.0) 2.2		
2	4 3 7	1.3'/2.0' (65%)			(2.2-3.2 Ft.) Loose, light olive gray (5Y 5/2), SILT, NR, damp, (ML), (FILL)	SP 2	
3	43				(481.0) 3.2 (3.2-29.2 Ft.) WASTE, damp		
4	4 3 2	0.4'/2.0' (20%)				SP 3	0.0 ppm PID
5	4						
6	8 6	0.7'/2.0' (35%)				SP 4	
7	10 5				@ 7.5 ft, moist		
8	1 2	0.4'/2.0' (20%)				SP 5	
9	2 4						
10	2 3	0.5'/2.0' (25%)			@ 9.6 ft, wet	SP 6	Faint petroleum odor
11	4 6						
12	6 3	0.5'/2.0' (25%)				SP 7	
13	4 4						
14	22 5 50/4	0.4'/2.0' (20%)				SP 8	

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1067709.56
DATUM EASTING: 514524.56 ELEVATION 484.2

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

BORING NO. LR-105

SHEET 2 OF 3

					DRILLING START TIME	DRILLING FINISH TIME
WATER LEVEL	21.3 FT.	32.0 FT.				
TIME	13:50	11:00			9:45	14:45
DATE	10/03/95	10/04/95			DATE 10/03/95	DATE 10/03/95
CASING DEPTH	28.0 FT.	36.0 FT.				

DRILL RIG CME 750
ANGLE 90° BEARING NA
SAMPLE HAMMER
SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
16	9	0.9' / 2.0' (45%)			(3.2-29.2 Ft.) WASTE, damp	SP (8)	0.0 ppm PID
	3						
	5						
17	6					SP (9)	
18	3	0.9' / 2.0' (45%)					
	5						
	7					SP (10)	
19	50/3						
20	50/5	0.4' / 2.0' (20%)			From 19.9-23.8 Ft, some Limestone and granular soil intermixed with waste	SP (11)	0.0 ppm PID
21							
22	7	1.0' / 2.0' (50%)					
	13					SP (12)	
	20						
23	12						
24	7	1.4' / 2.0' (70%)					Landfill gas odor 0.0 ppm PID Lost shoe on Split Spoon
	8						
	19					SP (13)	
25	17						
26	13	1.5' / 2.0' (75%)					
	21						
	17					SP (14)	
27	25						
28	9						0.0 ppm PID
	37						
	15					SP (15)	
29	11				(29.2-30.0 Ft.) Compact, medium gray (N5), SILTY CLAY, NR, wet, (CL), (FILL) From 29.2-29.8 Ft, layer of LIMESTONE GRAVEL		

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR105

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1067709.56
DATUM EASTING: 514524.56 ELEVATION 484.2

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

					START	FINISH
WATER LEVEL	21.3 FT.	32.0 FT.			TIME	TIME
TIME	13:50	11:00			9:45	14:45
DATE	10/03/95	10/04/95			DATE	DATE
CASING DEPTH	28.0 FT.	36.0 FT.			10/03/95	10/03/95

BORING NO. LR-105

SHEET 3 OF 3

DRILLING

DRILL RIG CME 750

ANGLE 90° BEARING NA

SAMPLE HAMMER

SURFACE CONDITIONS

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: LR105

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
31		0.9' 2.0' (45%)			(30.0-36.0 Ft.) WASTE, wet	ST (16)	@ 31.2 Ft., chunk of limestone crushed end of Shelby Tube 0.0 ppm PID
32	10 11 50/3	0.4' 2.0' (20%)				SP (17)	
33							
34	37 29 24 30	0.2' 2.0' (10%)				SP (18)	
35							
36	1 2 3 4	1.8' 2.0' (90%)			(448.2) 36.0 (36.0-38.0 Ft.) Loose, olive gray (5Y 4/1), SILT, little fine Sand, NR, moist, (ML), (LOESS)	SP (19)	0.0 ppm PID
37							
38					(446.2) 38.0 End of Soil Borehole Log at 38.0 Ft.		
39							
40							
41							
42							
43							
44							

Well No. LR-105

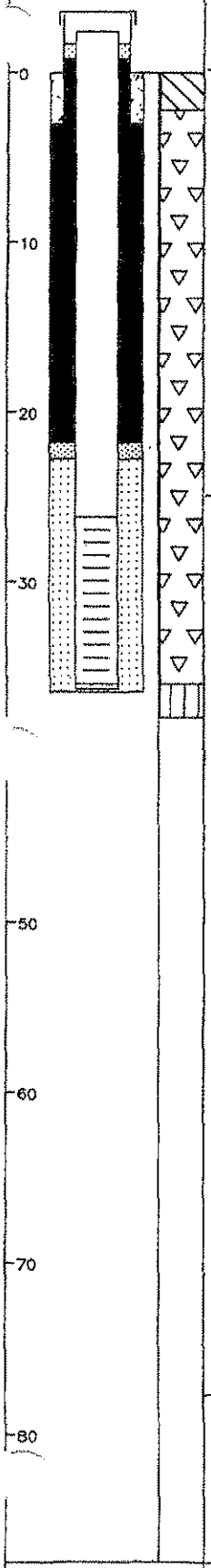
Boring No. X-Ref: LR-105

PIEZOMETER CONSTRUCTION SUMMARY

Survey Coords: Northing: 1067710 ft. Easting: 514525 ft.

Elevation Ground Level 484.2 ft. NGVD

Top of PVC Casing 486.79 ft. NGVD



Drilling Summary:

Total Depth 38.0 ft.

Borehole Diameter 8 1/4" (0.0-38.0')

Casing Stickup Height 2.59 ft.

Driller Layne-Western
St. Louis, MO

Rig CME 750

Bit(s) 4 1/4" ID Hollow Stem Auger Bit

Drilling Fluid None

Protective Casing 8x8" Square Steel, by 5' long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling CME 750	10/3/95	9:45	10/3/95	14:45
Geophys.Logging:				
Casing: 2" I.D. PVC	10/3/95	15:00	10/3/95	15:05
Filter Placement:	10/3/95	15:10	10/3/95	16:00
Cementing:				
Development				
Bentonite Grout Bentonite Seal	10/3/95	15:00	10/3/95	16:40

Well Design & Specifications

Basis: Geologic Log X Geophysical Log

Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 2.59	-	26.20	C1	486.79	-	458.00
26.20	-	36.00	S1	458.00	-	448.20
36.00	-	36.30	C2	448.20	-	447.90
	-				-	
	-				-	
	-				-	

Casing: C1 2" dia. Schedule 80 PVC, flush threaded with O-rings

C2 2" dia. threaded PVC end cap (4" long or 0.33')

Screen: S1 2" dia. Schedule 80 PVC, 0.010" machine cut slot, flush threaded with O-rings

Sand Pack: 16-35 mesh Silica Sand 22.8-36.5'

Filter Pack: Less than 50 mesh Silica Sand 21.8-22.8'

Grout Seal:

Bentonite Seal: Extra high yield Wyo-Ben (100%) Chips 3.0-21.8'

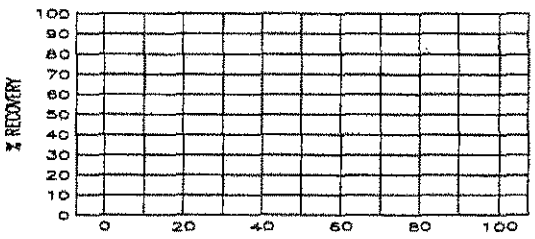
Concrete: 0.0-3.0'

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments:

Drilled to 36.0' and collected split spoon sample from 36.0-38.0'

Not to Scale

Supervised by B. Harrington

Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO

File Name LR105

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF. NO. 145109	
C.R. NO.	CHECK NO.
STATE WELL NUMBER	TRANSMITTAL NO.
CHECKED BY	ROUTE
APPROVED BY	ENTERED Ph 1 Ph 2 Ph 3

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

SITE/FACILITY NAME: LAIDLAW BRIDGETON SANITARY LANDFILL		WELL NUMBER: LR-105	
SITE ADDRESS: ST. CHARLES ROCK RD	CITY: BRIDGETON	STATE: MO	ZIP CODE: 63044
OWNER NAME: LAIDLAW WASTE SYSTEMS, INC.		TELEPHONE: 314-241-3710	
OWNER ADDRESS: 1838 N. BROADWAY	CITY: ST. LOUIS	STATE: MO	ZIP CODE: 63102

VARIANCE ISSUED ☐ YES ☒ NO — DATE ISSUED: — VARIANCE NUMBER: V

DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT:
90' EAST OF WEST FENCE LINE AND 320' NORTH OF SOUTHWEST FENCE CORNER

LOCATION OF WELL — SHOW LOCATION IN SECTION PLAT
COUNTY: ST. LOUIS — SURFACE ELEVATION: 484.2
SMALLEST ¼ ____ ¼ ____ ¼ ____ ¼ ____ ¼ LARGEST ¼
SEC. ____ TWN. 47 N, RNG. 5 E OR W
LAT. 38 ° 45 ' 57 " LONG. 90 ° 26 ' 57 "

MONITORING WELL INSTALLATION CONTRACTOR'S NAME	LAYNE WESTERN CO., INC.	PERMIT NUMBER	001258 WPM
DRILLING CONTRACTOR'S NAME	LAYNE WESTERN CO., INC.	PERMIT NUMBER	001258 WPM

WELL CONSTRUCTION INFORMATION

TYPE OF WELL: ☐ MONITORING WELL ☒ PIEZOMETER ☐ OTHER
TYPE OF POTENTIAL SITE: ☐ HAZARDOUS MATERIAL ☒ LANDFILL ☐ OTHER ☐ L.U.S.T.
MONITORING FOR (CHECK ALL THAT APPLY): ☒ V.O.C. ☐ METALS ☐ PETROLEUM PRODUCT ONLY ☐ OTHER

PROTECTIVE CASING DETAILS (IF USED): LENGTH 5 FT. — DIAMETER OF CASING 8×8 IN. — WEIGHT OR SDR # 0.188" — DIAMETER AND DEPTH OF DRILL HOLE 8¼ IN. 38 FT. — JOINTS: ☐ MECHANICAL ☐ THREADED ☐ WELDED ☐ OTHER — MATERIAL: ☐ THERMO PLASTIC ☒ STEEL ☐ FLUORO POLYMER TYPE — LOCKING CAP? ☒ YES ☐ NO

CAP VENTED ☒ YES ☐ NO — WEEP HOLE? ☒ YES ☐ NO
CASING GROUT DETAILS — MATERIAL: ☐ CEMENT ☒ CONCRETE ☐ OTHER
DEPTH FROM THE SURFACE TO THE BOTTOM OF THE CASING GROUT SEAL: 3.0 FT.
TYPE OF SURFACE COMPLETION: ☒ ABOVE GROUND ☐ FLUSH MOUNT
DESCRIBE HOW THE FLUSH MOUNT WAS CONSTRUCTED:

CENTRALIZER USED ON RISER: ☒ NO ☐ YES LOCATED AT ____ — MATERIAL: ☐ STAINLESS STEEL ☐ OTHER

RISER PIPE DETAILS: LENGTH 28.9 FT. — DIAMETER OF RISER PIPE 2 IN. — WEIGHT OR SDR # SCH 80 — DIAMETER OF DRILL HOLE 8¼ IN. — JOINTS: ☒ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER — MATERIAL: ☒ THERMO PLASTIC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER

ANNULAR SEAL: ☐ CEMENT SLURRY ☒ BENTONITE SLURRY ☐ NON SLURRY BENTONITE TYPE: — ☐ CEMENT/BENTONITE SLURRY BAGS OF CEMENT USED ____ % BENTONITE USED ____ WATER USED/BAG ____ GAL.
BENTONITE SEAL — MATERIAL BENTONITE: ☒ SLURRY ☐ CHIPS ☐ GRANULAR ☐ PELLETS — LENGTH OF SEAL 18.8 — BENTONITE SEAL INSTALLED IN: ☒ UNSATURATED ZONE ☐ SATURATED ZONE

PRIMARY FILTER PACK: TYPE ☒ SAND ☐ MANUFACTURED ☐ NATURAL — GRAIN SIZE 16-35 — LENGTH OF FILTER PACK 15.2 FT. — METHOD OF INSTALLATION H.S.A. POUR
SECONDARY FILTER PACK: TYPE ☒ SAND ☐ MANUFACTURED ☐ NONE — GRAIN SIZE 100 — LENGTH OF FILTER PACK 1.0 FT. — METHOD OF INSTALLATION H.S.A. POUR
WELL SCREEN: LENGTH OF SCREEN 10 FT. — DIAMETER 2 IN. — SLOT SIZE 10 — WEIGHT OR SDR # SCH 80 — MATERIAL ☒ PLASTIC ☐ STEEL ☐ FLUORO POLYMER
SUMP DETAILS: LENGTH OF SUMP — DIAMETER OF SUMP — MATERIAL ☐ PVC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER
BACK FILL: WAS THE WELL BACK FILLED? ☐ YES ☒ NO — MATERIAL USED — LENGTH OF BACK FILLED BORE HOLE

Information in this column to be supplied in the Feet from Surface column	FEET FROM SURFACE	FORMATION DESCRIPTION
Depth to bottom of Protective Casing Seal:	3.0	0-2 Clay
Depth to Base of Annular Seal:	21.8	2-36 Trash
Depth to Base of Bentonite Seal:	21.8	
Depth to Top of Primary Filter Pack:	22.8	
Depth to Top of the Screen:	26.3	
Depth to Bottom of the Screen:	36.3	36-38 Silt
Total Depth:	38.0	

STATIC WATER LEVEL ____ FEET FROM MEASURING POINT
DATE OF STATIC WATER LEVEL
MEASURING POINT FOR STATIC WATER LEVEL IS: ☒ TOP OF RISER PIPE ☐ OTHER
ELEVATION OF MEASURING POINT: 486.79

MULTIPLE CASED WELLS: SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.

DRILLING EQUIPMENT: ☐ AIR ROTARY ☒ AUGER TYPE 4¼ H.S.A. ☐ REVERSE ROTARY ☐ OTHER

DATE WELL DRILLING WAS COMPLETED: 10-03-95

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE PRIMARY CONTRACTOR/PERMIT #	DATE	SIGNATURE DRILLER/PERMIT #	DATE
Lerman D. Mahurin Jr.	11-15-95	Lerman D. Mahurin Jr.	11-15-95

MO 780-1415 (7-95)

DISTRIBUTION: WHITE/DIVISION CANARY/MONITORING WELL CONTRACTOR PINK/OWNER
MAIL WHITE COPY TO: DEPARTMENT OF NATURAL RESOURCES, P.O. BOX 250, ROLLA, MO 65402
ENCLOSE $35 PER MONITORING WELL FOR THE CERTIFICATION FEE WITHIN 60 DAYS AFTER WELL COMPLETION

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD:					BORING NO.
LAIDLAW/OU2 RI-FS/MO WEST LAKE LANDFILL OPERABLE UNIT 2	6.25 inch I.D. Hollow Stem Auger					PZ-107-SS
						SHEET 1 OF 3
	SAMPLING METHOD:					DRILLING
	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)					START TIME 13:00 / FINISH TIME 16:25
	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)					
	WATER LEVEL					
	TIME					
	DATE					START DATE 3/26/95 / FINISH DATE 3/26/95
NORTHING: 1067163.45 DATUM EASTING: 515254.52 ELEVATION 462.6	CASING DEPTH					

DRILLING CONTR LAYNE-WESTERN

DRILL RIG CME 75	SURFACE CONDITIONS		
ANGLE -90° BEARING			
SAMPLE HAMMER			

LOGGED BY S. COSIO DATE 6/1/95 CHK'D BY W. HERST

JOB NO.: 943-2848 FILENAME: PZ107SS

DEPTH IN FEET (ELEVATION)	BLOW/6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
1	3 5 5 5	0.9'/2.0' (45%)			(0.0-2.0 ft.) Stiff, moderate yellowish brown (10YR 5/4), SILTY CLAY, trace of very fine Sand, WR, damp, (CL), (FILL)	SP ①	
2 3	2 2 4 18	1.0'/2.0' (50%)			(2.0-4.0 ft.) Firm, yellowish brown (10YR 5/4), SILTY CLAY, little Gravel, trace amount of trash at bottom, WR, damp, (CL), (FILL)	SP ②	
4 5	3 8 11 10	1.1'/2.0' (55%)			(4.0-6.0 ft.) Very stiff, medium light gray (N5) to dark greenish gray (5GY 4/1), SILTY CLAY, some Gravel, SR, moist, (CL), (FILL)	SP ③	
6					(456.6) 6.0		
6 7	4 8 23 5	1.1'/2.0' (55%)			(6.0-8.0 ft.) Mixed damp waste and silty clay	SP ④	
8 9	7 2 4 1	0.3'/2.0' (15%)			(8.0-10.0 ft.) Trash	SP ⑤	
10 11	3 3 4 4	0.0'/2.0' (0%)			(10.0-12.0 ft.) Waste becomes wet	SP ⑥	
12					(450.6) 12.0		From 12.0-28.0 ft., no samples recovered, but drilling indicated mixed waste and silty clay layers
12 13	8 32 15 9	0.0'/2.0' (0%)	NO RECOVERY		(12.0-14.0 ft.) No Recovery	SP ⑦	
14	6 12 8 5	0.0'/2.0' (0%)			(14.0-15.0 ft.) No Recovery	SP ⑧	

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD:		BORING NO.
LAIDLAW/OU2 RI-FS/MD WEST LAKE LANDFILL OPERABLE UNIT 2	6.25 inch I.D. Hollow Stem Auger		PZ-107-SS
			SHEET 2 OF 3
	SAMPLING METHOD:		DRILLING
	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)		START TIME 13:00 / FINISH TIME 16:25
	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)		START DATE 3/26/95 / FINISH DATE 3/26/95
NORTHING: 1067163.45 DATUM EASTING: 515254.52 ELEVATION 462.6	WATER LEVEL / TIME / DATE / CASING DEPTH		

DRILL RIG CME 75	SURFACE CONDITIONS
ANGLE -90° BEARING	
SAMPLE HAMMER	

DRILLING CONTR LAYNE-WESTERN

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
16	5 8 13 6	0.0"/2.0" (0%)	NO RECOVERY		(15.0-16.0 Ft.) No Recovery	SP (8)	
					(16.0-18.0 Ft.) No Recovery	SP (9)	
18	5 7 35 41	0.0"/2.0" (0%)			(18.0-20.0 Ft.) No Recovery	SP (10)	
20	5 5 5 3	0.0"/2.0" (0%)			(20.0-22.0 Ft.) No Recovery	SP (11)	
22	5 4 7 9	0.0"/2.0" (0%)			(22.0-24.0 Ft.) No Recovery	SP (12)	
24	6 7 7 10	0.0"/2.0" (0%)			(24.0-26.0 Ft.) No Recovery	SP (13)	
26	5 5 9 12	0.4"/2.0" (20%)			(26.0-28.0 Ft.) Waste	SP (14)	
28					(434.6) 28.0 (28.0-32.0 Ft.) Stiff, dark greenish gray (5GY 4/1), SILTY CLAY, NR, wet, (CL), (LOESS)		
29							

LOGGED BY S. CRISIP DATE 6/1/95 CHK'D BY W. HINST

JOB NO.: 943-2848

FILENAME: PZ107SS

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD:	BORING NO.
	6.25 inch I.D. Hollow Stem Auger	PZ-107-SS
		SHEET 3 OF 3
	SAMPLING METHOD:	
LAIDLAW/OU2 RI-FS/MD WEST LAKE LANDFILL OPERABLE UNIT 2	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)	DRILLING
	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)	START / FINISH
	WATER LEVEL	TIME / TIME
	TIME	13:00 / 16:25
	DATE	DATE / DATE
NORTHING: 1067163.45 DATUM EASTING: 515254.52 ELEVATION 462.6	CASING DEPTH	3/26/95 / 3/26/95

DRILL RIG CME 75	SURFACE CONDITIONS
ANGLE -90° BEARING	
SAMPLE HAMMER	

DRILLING CONTR LAYNE-WESTERN

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE		REMARKS
31					(28.0-32.0 ft.) Stiff, dark greenish gray (5GY 4/1), SILTY CLAY, NR, wet, (CL), (LOESS)			
32					(430.6) 32.0 End of Soil Borehole Log at 32.0 ft.			
33					See PZ-107-SS Record of Drillhole for rock descriptions below 55.0 ft.			
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								

LOGGED BY S. COSIO CHK'D BY W. HERST

DATE 6/1/95

JOB NO.: 943-2848

FILENAME: PZ107SS

RECORD OF DRILLHOLE PZ-107-SS

Sheet 1 of 4

PROJECT: LAIDLAW/RI-FS
PROJECT NO: 943-2848
LOCATION: BRIDGETON, MO

BORING METHOD: NX Core & water
DRILLING DATE: 5/21/95 - 5/22/95
DRILL RIG: CME 75

DATUM: MSL
COORDINATES N: 1087183.45
AZIMUTH: 0

COLLAR ELEV: 462.6
E: 515254.52
INCLINATION: -90

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Slikensided, SM-Smooth, R-Rough, VR-V. Rough
Fe-FeOxide, CL-Clay Infill, CH-Chlorite, H-Healed, GRF-Gravel Filled

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: DIP wrt CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX: SW FR / MW / HW / CW	STRENGTH INDEX: R6 R5 R4 R3 R2 R1	POINT LOAD INDEX (psi): R1 30 R2 150 R3 300 R4 600 R5 1500 R6	TEST ORIENTATION	NOTES WATER LEVELS INSTRUMENTATION
48	0.0-32.0 ft. See Soil Borehole Log PZ-107-SS 32.0-54.0 ft. No samples collected														5/18/95 - 5/19/95 A 9 7/8 in. borehole (air rotary) was advanced through 10 1/4 in. ID hollow stem augers from 30.0-55.0 ft., and 6 in. steel was sealed in borehole from surface to 55.0 ft. with neat cement. Bedrock was encountered at 51.0 ft. BGS during drilling
50															
52															
54	408.60 54.0-59.0 ft. Fresh, medium bedded, pale yellowish brown (10YR 6/2), fine grained, medium strong, LIMESTONE, (ST. LOUIS FORMATION)		408.60 54.00												5/21/95 @ 15:30 Began coring
56				1	92%				J,PL,SM,CL						
58									J,PL,SM						5/21/95 @ 15:50 End of Run 1
	59.0-63.5 ft. Slightly weathered, medium bedded, light olive gray (5Y 5/2), medium grained, medium strong, ARGILLACEOUS LIMESTONE, (ST. LOUIS FORMATION)		403.60 59.00												
60	60.0 ft. Fossiliferous								J,PL,R B,PL,SM						
				2	98%				J,PL,SM,CL J,PL,R						
62															
	63.5-82.3 ft. Fresh, medium to thinly bedded, pale yellowish brown (10YR 6/2), m-c grained, medium strong LIMESTONE, (ST. LOUIS FORMATION)								B,PL,SM						
64															

DEPTH SCALE: 1:2
DRILLING CONTRACTOR: LAYNE-WESTERN
DRILLER: D. MAHURIN

LOGGED: D. ALLOWAY
CHECKED: B. TILTON
DATE: 6/20/95

Golder Associates

RECORD OF DRILLHOLE PZ-107-SS

PROJECT: LAIDLAW/FI-FS
PROJECT NO: 943-2848
LOCATION: BRIDGETON, MO

BORING METHOD: NX Core & water
DRILLING DATE: 5/21/95 - 5/22/95
DRILL RIG: CME 75

DATUM: MSL
COORDINATES N: 1067183.45
AZIMUTH: 0

COLLAR ELEV: 462.6
E: 515254.52
INCLINATION: -90

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Slikensided, SM-Smooth, R-Rough, VR-V. Rough
Fe-FeOxide, CL-Clay Infill, CH-Chlorite, H-Healed, GRF-Gravel Filled

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: DIP wrt CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX (SW FR, HW CW)	STRENGTH INDEX	POINT LOAD INDEX (psi)	TEST ORIENTATION	NOTES WATER LEVELS INSTRUMENTATION
64	63.5-82.3 ft. Fresh, medium to thinly bedded, pale yellowish brown (10YR 6/2), m-c grained, medium strong LIMESTONE, (ST. LOUIS FORMATION)								B,PL,SM			R6 R5 R4 R3 R2 R1	R6 R5 R4 R3 R2 R1		
66	64.3 ft. Argillaceous layers common, stylolites common								B,PL,SM,CL						
				2	98%				J,PL,SM						
68									J,PL,SM,CL						
									J,PL,SM,CL						5/21/95 @ 16:15 End of Run 2
			383.60 89.00												
70									J,PL,R						
									B,PL,SM,CL (5)						
72	72.1-72.6 ft. Argillaceous layer								B,PL,SM,CL						
									J,I,R						
74				3	100 %				B,PL,SM,CL						
76	76.7-77.2 ft. Argillaceous layer														
78	78.4-79.9 ft. Argillaceous layer								J,PL,SM (2)						5/21/95 @ 17:40 End of Run 3
			383.60 79.00												
				4	100 %				J,PL,SM						
80															

DEPTH SCALE: 1:2
DRILLING CONTRACTOR: LAYNE-WESTERN
DRILLER: D. MAHURIN

LOGGED: D. ALLOWAY
CHECKED: B. TILTON
DATE: 6/20/95

Golder Associates

RECORD OF DRILLHOLE PZ-107-SS

Sheet 3 of 4

PROJECT: LAIDLAW/RI-FS
PROJECT NO: 943-2848
LOCATION: BRIDGETON, MO

BORING METHOD: NX Core & water
DRILLING DATE: 5/21/95 - 5/22/95
DRILL RIG: CME 75

DATUM: MSL
COORDINATES N: 1087163.45
AZIMUTH: 0

COLLAR ELEV: 482.6
E: 515254.52
INCLINATION: -90

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough
Fe-FeOxide, CL-Clay Infill, CH-Chlorite, H-Healed, GRF-Gravel Filled

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: DIP wrt CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	TEST ORIENTATION	NOTES WATER LEVELS INSTRUMENTATION
80	63.5-82.3 ft. Fresh, medium to thinly bedded, pale yellowish brown (10YR 6/2), m-c grained, medium strong LIMESTONE, (ST. LOUIS FORMATION)							90	J,PL,SM (3)						
82								90	J,PL,SM (2)						
	82.3-84.6 ft. Slightly weathered, medium bedded, light olive gray (5Y 5/2), medium grained, medium strong, ARGILLACEOUS LIMESTONE, (ST. LOUIS FORMATION)														
84															
	84.6-88.5 ft. Fresh, medium bedded, pale yellowish brown (10YR 6/2), fine grained, medium strong, LIMESTONE, (ST. LOUIS FORMATION) Thinly laminated Clay layers abundant			4	100 %										
86								90	J,PL,SM,CL (2)						
								90	J,C,SM						
88															
	88.5-94.1 ft. Fresh, medium bedded, light olive gray (5Y 5/2), fine grained, medium strong, ARGILLACEOUS LIMESTONE, (ST. LOUIS FORMATION) Stylolites abundant		373.60 / 89.00												5/21/95 @ 18:40 End of Run 4 Quit drilling for the day 5/22/95 @ 7:30 Began drilling
90															
92				5	100 %										
94	94.1-97.2 ft. Fresh, thinly bedded, pale yellowish brown (10YR 6/2), fine grained, medium strong, LIMESTONE, (ST. LOUIS FORMATION) Abundant thinly laminated Clay layers							90	B,PL,SM,CL (3)						
96															

DEPTH SCALE: 1:2
DRILLING CONTRACTOR: LAYNE-WESTERN
DRILLER: D. MAHURIN

LOGGED: D. ALLOWAY
CHECKED: B. TILTON
DATE: 6/20/95

Golder Associates

RECORD OF DRILLHOLE PZ-107-SS

Sheet 4 of 4

PROJECT: LAIDLAW/RI-FS
PROJECT NO: 943-2848
LOCATION: BRIDGETON, MO

BORING METHOD: NX Core & water
DRILLING DATE: 5/21/95 - 5/22/95
DRILL RIG: CME 75

DATUM: MSL
COORDINATES N: 1087163.45
AZIMUTH: 0

COLLAR ELEV: 462.6
E: 513254.52
INCLINATION: -90

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Slikensided, SM-Smooth, R-Rough, VR-V. Rough
Fe-FeOxide, CL-Clay Infill, CH-Chlorite, H-Healed, GRF-Gravel Filled

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: DIP wrt CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX (SW FR, MW, HW, CW)	STRENGTH INDEX (R6, R5, R4, R3, R2, R1)	POINT LOAD INDEX (psi) (R1 30, R2 150, R3 300, R4 600, R5 1500, R6)	TEST ORIENTATION	NOTES WATER LEVELS INSTRUMENTATION
96	94.1-97.2 ft. Fresh, thinly bedded, pale yellowish brown (10YR 6/2), fine grained, medium strong, LIMESTONE,(ST. LOUIS FORMATION) Abundant thinly laminated Clay layers								B,PL,SM						
98	97.2-100.7 ft. Slightly weathered, medium bedded, light olive gray (5Y 5/2), fine to medium grained, medium strong, ARGILLACEOUS LIMESTONE, (ST. LOUIS FORMATION) Calcite filled healed fractures common		363.60	5	100 %	80 80 40 20	2 4 6 8 10	0 30 60 90							5/22/95 @ 8:10 End of Run 5
100			99.00						J,PL,R,CL						
102	100.7-104.0 ft. Fresh, thinly bedded, pale yellowish brown (10YR 6/2), f-m grained, medium strong, LIMESTONE, (ST. LOUIS FORMATION) Abundant thinly laminated clay layers			6	100 %				J,PL,R						
									J,PL,R						
104			358.60						J,PL,R						5/22/95 @ 8:30 Finished coring
	End of Record of Borehole at 104.0 ft.		104.00												
106															
108															
110															
112															

DEPTH SCALE: 1:2
DRILLING CONTRACTOR: LAYNE-WESTERN
DRILLER: D. MAHURIN

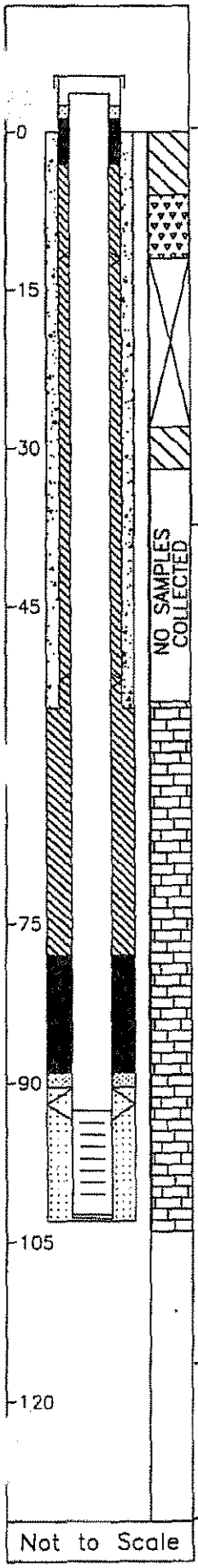
LOGGED: D. ALLOWAY
CHECKED: B. TILTON
DATE: 6/20/95

Golder Associates

Well No. PZ-107-SS

Boring No. X-Ref: PZ-107-SS

PIEZOMETER CONSTRUCTION SUMMARY



Not to Scale

Survey Coords: Northing: 1067163 ft. Easting: 515255 ft.

Elevation Ground Level 462.6 ft. NGVD

Top of PVC Casing 464.66 ft. NGVD

Drilling Summary:

Total Depth 103.0 ft.

Borehole Diameter 14 1/4 in. (0.0–32.0 ft.) 5 7/8 in. (32.0–103.0 ft.)

Casing Stickup Height 2.03 ft.

Driller Layne-Western, St. Louis, MO

Rig CME 75, Schramm Portadrill T660H

Bit(s) 6 1/4 in. ID Hollow Stem Auger Bit, NX Core, 5 7/8 in. Button Bit for Reaming

Drilling Fluid Auger–None, NX Core Water, Air and Mud Rotary

Protective Casing 8x8 in. Square Steel, by 5 ft. long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
CME 75 (augers)	3/28/95	13:00	3/28/95	16:25
CME 75 (core)	5/21/95	15:30	5/22/95	8:30
Schramm Rotary	5/22/95	11:00	5/22/95	11:30
Geophys.Logging:				
Casing:				
2" PVC	5/22/95	11:30	5/22/95	11:35
6" Steel	5/18/95	9:00	5/18/95	14:00
Filter Placement:	5/22/95	11:40	5/22/95	11:55
Cementing:				
Development				
Bentonite Grout	5/22/95	12:10	5/22/95	12:45
Bentonite Seal	5/22/95	11:55	5/22/95	12:10

Well Design & Specifications

Basis: Geologic Log X Geophysical Log

Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 2.03	–	92.60	C1	464.86	–	370.03
92.60	–	102.40	S1	370.03	–	360.23
102.40	–	102.73	C2	360.23	–	359.90
+ 1.00	–	55.00	C3	463.60	–	407.63
	–				–	
	–				–	

Casing: C1 2 in. dia. Schedule 80 PVC, flush threaded with O-rings

C2 2 in. dia. threaded PVC end cap (4 in. long or 0.33 ft.) (C3-see comments)

Screen: S1 2 in. dia. Schedule 80 PVC, 0.010 in. machine cut slot, flush threaded with O-rings

Sand Pack: 16–35 mesh Silica Sand, 90.4–103.0 ft.

Filter Pack: Less than 50 mesh Silica Sand, 89.0–90.4 ft.

Grout Seal: Wyo-Ben Grout Well Bentonite Slurry, 3.0–78.0 ft.

Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry, 78.0–89.0 ft.

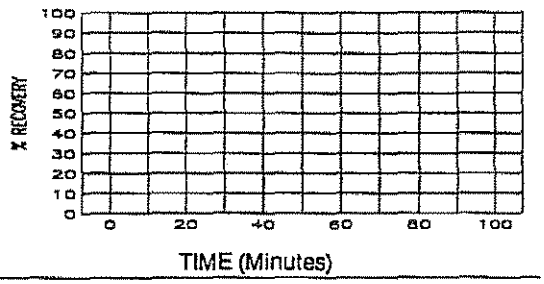
Concrete: 0.0–3.0 ft.

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments:

Surface Casing C3: 6 1/8 ID / 6 5/8 in. OD Steel Casing

Supervised by B. Tilton

Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO

File Name PZ107SS

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF NO 122508	CHECK NO.
ROUTE	TRANSMITTAL NO
STATE WELL NUMBER	CROSS REFERENCE NO
CHECKED BY	ENTERED Ph 1 Ph 2 Ph 3
APPROVED BY	DATE APPROVED

INFORMATION SUPPLIED BY OWNER

SITE NAME	WELL NUMBER
LAIDLAW BRIDGETON SANITARY LANDFILL	PZ - 10755

SITE ADDRESS	CITY	STATE	ZIP CODE
9T CHARLES ROCK RD	BRIDGETON	MO	63044

NAME	TELEPHONE
LAIDLAW WASTE SYSTEMS, INC.	314-344-3710

ADDRESS	CITY	STATE	ZIP CODE
1638 N. BROADWAY	ST. LOUIS	MO	63102

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

LOCATION OF WELL SHOW LOCATION IN SECTION PLAT

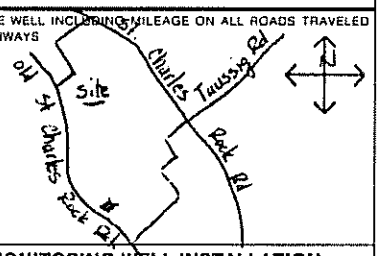
COUNTY ST. LOUIS
ELEVATION 450.6
AREA NO.

SMALLEST ¼ LARGEST ¼

SEC ____ TWN. 47 N,RNG. 5 E OR W

LAT. 38° 45' 53" LONG. 90° 26' 48"

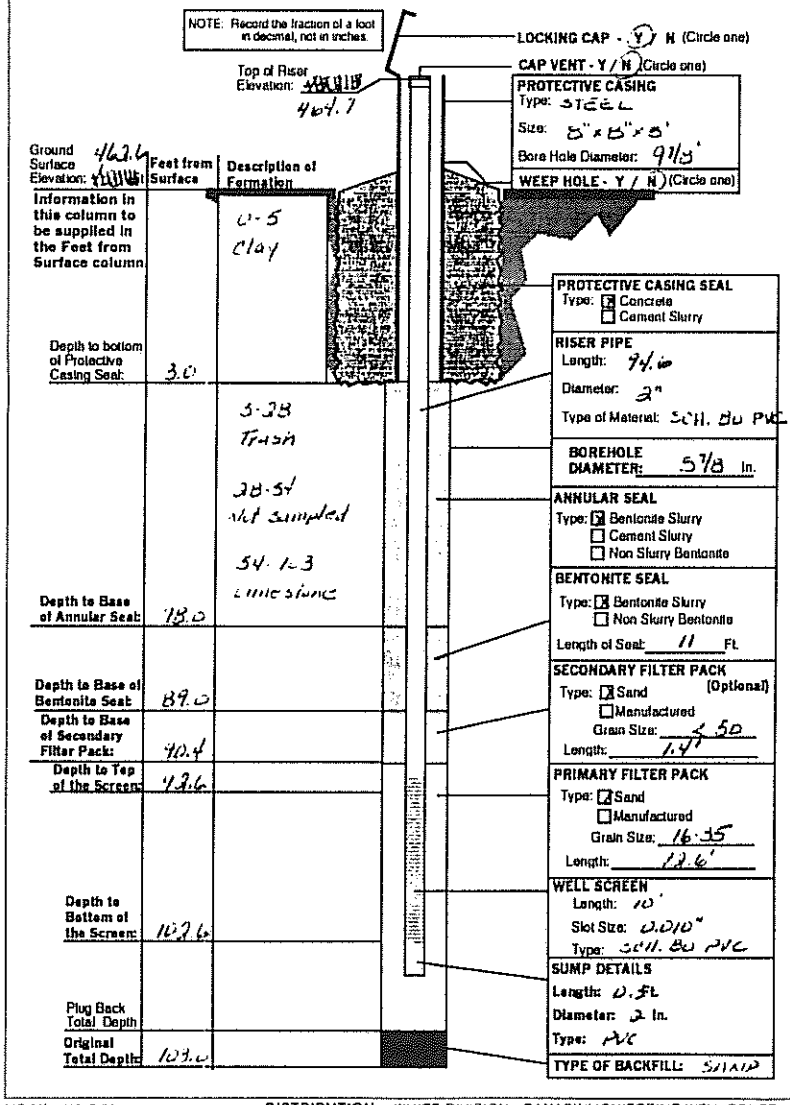
SKETCH THE LOCATION TO THE WELL INCLUDING MILEAGE ON ALL ROADS TRAVELED FROM NEAREST TOWNS OR HIGHWAYS



DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT

MONITORING WELL INSTALLATION CONTRACTOR'S NAME

LAYNE WESTERN Co, INC.



DRILLING CONTRACTOR'S NAME

LAYNE WESTERN Co, INC.

TYPE OF INSTALLATION
☒ ABOVE GROUND ☐ FLUSH MOUNT

STATIC WATER LEVEL
FEET FROM MEASURING POINT

DATE OF STATIC WATER LEVEL

ELEVATION OF MEASURING POINT
464.7

MEASURING POINT IS
☒ TOP OF RISER PIPE
☐ OTHER

DRILLING EQUIPMENT
☒ AIR ROTARY ☒ AUGER TYPE 6¼ HSA
☐ REVERSE ROTARY ☐ OTHER

CENTRALIZERS USED
☒ YES, AT 4 TOTAL
☒ STAINLESS STEEL
☐ OTHER
☐ NO

MULTIPLE CASED WELLS

SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.

DATE WELL CONSTRUCTION WAS COMPLETED
5-22-95

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE (MONITORING WELL CONTRACTOR) Michael P. Vogt

PERMIT NUMBER	DATE
001256WM	6-02-95

SIGNATURE (DRILLING CONTRACTOR) Michael P. Vogt

PERMIT NUMBER	DATE
001256WM	6-02-95

MO 780-1415 (2-94) DISTRIBUTION: WHITE DIVISION CANARY MONITORING WELL CONTRACTOR PINK/OWNER

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD: 6.25 inch I.D. Hollow Stem Auger		BORING NO. PZ-205-AS
LAIDLAW/OU2 RI-FS/MO WEST LAKE LANDFILL OPERABLE UNIT 2	SAMPLING METHOD: SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP) SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)		SHEET 1 OF 4 DRILLING
NORTHING: 1067463.60 DATUM EASTING: 515463.34 ELEVATION 459.3	WATER LEVEL / TIME / DATE / CASING DEPTH	START: TIME 16:35, DATE 3/25/95	FINISH: TIME 11:00, DATE 3/25/95
DRILL RIG CME 75 - TRUCK MOUNT	SURFACE CONDITIONS		
ANGLE -90° BEARING			
SAMPLE HAMMER			

DRILLING CONTR LAYNE-WESTERN

LOGGED BY S. COSIO CHK'D BY V. HERST

DATE 6/1/95

JOB NO.: 943-2848

FILENAME: PZ205AS

DEPTH IN FEET (ELEVATION)	BLOW/6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
1	4, 7, 7, 10	1.5'/2.0' (75%)			(0.0-2.2 Ft.) Stiff, dark greenish gray (5GY 4/1) to olive gray (5Y 6/1), SILTY CLAY, trace Fine Sand, SR, damp, (CL), (FILL)	SP (1)	
2					(457.1) 2.2		
3	1, 2, 2, 4	0.5'/2.0' (25%)			(2.2-6.0 Ft.) Soft, black (N1), CLAYEY SILT, trace Fine Sand, WR, moist to wet, (CL-ML), (FILL)	SP (2)	
4							
5	2, 2, 2, 3	1.5'/2.0' (75%)				SP (3)	Soil becomes wet @ 4.0 Ft.
6					(453.3) 6.0		
7	1, 4, 4, 3	0.1'/2.0' (5%)			(6.0-12.0 Ft.) Mixed wet waste and clayey silt	SP (4)	
8							
9	6, 5, 6, 4	0.1'/2.0' (5%)			(8.0-10.0 Ft.) Mixed wet waste and clayey silt	SP (5)	
10							
11	2, 2, 3, 3	0.6'/2.0' (30%)				SP (6)	
12					(447.3) 12.0		
13	2, 9, 3, 2	0.0'/2.0' (0%)	NO RECOVERY		(12.0-14.0 Ft.) No Recovery	SP (7)	From 12.0-28.0 Ft., no samples recovered, but drilling indicated mixed waste and silty clay layers
14	6, 8, 8, 7	0.0'/2.0' (0%)			(14.0-15.0 Ft.) No Recovery	SP (8)	

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD:		BORING NO.
	6.25 inch I.D. Hollow Stem Auger		PZ-205-AS
			SHEET 2 OF 4
	SAMPLING METHOD:		
LAIDLAW/OU2 RI-FS/MO WEST LAKE LANDFILL OPERABLE UNIT 2	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)		DRILLING
	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)		START / FINISH
NORTHING: 1067463.60 DATUM EASTING: 515463.34 ELEVATION 459.3	WATER LEVEL		TIME 16:35 / TIME 11:00
	TIME		
	DATE		DATE 3/25/95 / DATE 3/25/95
	CASING DEPTH		
DRILL RIG CME 75 - TRUCK MOUNT	SURFACE CONDITIONS		
ANGLE -90° BEARING			
SAMPLE HAMMER			

DRILLING CONTR LAYNE-WESTERN

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
16	5 5 5 4	0.0' / 2.0' (0%)	NO RECOVERY		(15.0-16.0 ft.) No Recovery	SP (8)	
					(16.0-18.0 Ft.) No Recovery	SP (9)	
18	5 2 1 5	0.0' / 2.0' (0%)			(18.0-20.0 Ft.) No Recovery	SP (10)	
20	1 2 3 3	0.0' / 2.0' (0%)			(20.0-22.0 ft.) No Recovery	SP (11)	
22	3 2 1 4	0.0' / 2.0' (0%)			(22.0-24.0 ft.) No Recovery	SP (12)	
24	3 3 23 50/1"	0.0' / 2.0' (0%)			(24.0-26.0 ft.) No Recovery	SP (13)	
26	8 6 8 10	0.0' / 2.0' (0%)			(26.0-28.0 ft.) No Recovery	SP (14)	
28	1 2 4 5	0.0' / 2.0' (0%)			(431.3) 28.0 (28.0-30.0 ft.) Loose, dark greenish gray (5GY 4/1), SANDY SILT, NR, wet, (ML)	SP (15)	
29							

LOGGED BY S. CUSIO

DATE 6/1/95 CHK'D BY W. HERST

JOB NO.: 943-2848

FILENAME: PZ205AS

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD:		BORING NO.
	6.25 inch I.D. Hollow Stem Auger		PZ-205-AS
			SHEET
	SAMPLING METHOD:		3 OF 4
	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)		DRILLING
LAIDLAW/OU2 RI-FS/MO WEST LAKE LANDFILL OPERABLE UNIT 2	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)		START / FINISH
	WATER LEVEL		TIME / TIME
	TIME		16:35 / 11:00
	DATE		DATE / DATE
NORTHING: 1067463.60 DATUM EASTING: 515463.34 ELEVATION 459.3	CASING DEPTH		3/25/95 / 3/25/95

DRILL RIG CME 75 - TRUCK MOUNT | SURFACE CONDITIONS

ANGLE -90° BEARING

SAMPLE HAMMER

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
31					(30.0-31.0 ft.) No samples collected		5/21/95, 10.0 in. ID steel casing installed through 10.25 in. ID augers to 29.0 ft. Casing sealed in borehole with neat cement grout to surface.
					(428.3) 31.0		
31	6 5 5 8	1.2'/2.0' (60%)			(31.0-36.5 ft.) Stiff, medium dark gray (N4), SILTY CLAY, with thin fine sand layers (1' thick), moist, NR, (CL), (ALLUVIUM)	SP (16)	
33	9 3 5 12	1.3'/2.0' (65%)				SP (17)	
35	7 7 9 9	1.0'/2.0' (50%)				SP (18)	
					(422.8) 36.5		
37	7 14 21 17	1.1'/2.0' (55%)			(36.5-39.0 ft.) Dense, olive gray (5Y 4/1), SILTY fine SAND, wet, NR, (SM), (ALLUVIUM)	SP (19)	
					(420.3) 39.0		
39	4 3 3 4	1.4'/2.0' (70%)			(39.0-44.2 ft.) Firm, olive gray (5Y 4/1), SILTY CLAY, moist to wet, NR, (CL)	SP (20)	
40					from 40.2-40.4 ft., wet, fine, sandy clay layer		
41	3 4 4 5	1.7'/2.0' (85%)			from 41.8-42.0 ft., wet, fine, sandy clay layer	SP (21)	
43	2 7 11 18	1.3'/2.0' (65%)				SP (22)	
					(415.1) 44.2		
44					(44.2-49.0 ft.) Compact, olive gray (5Y 4/1), fine SAND, trace silt, wet, NR, (SM), (ALLUVIUM)		

DRILLING CONTR LAYNE-WESTERN

LOGGED BY S. CASSIO CHK'D BY W. HERST

DATE 6/1/95

JOB NO.: 943-2848

FILENAME: PZ205AS

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1067463.60
DATUM EASTING: 515463.34 ELEVATION 459.3

DRILLING METHOD: 6.25 inch I.D. Hollow Stem Auger

SAMPLING METHOD: SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

BORING NO. PZ-205-AS

SHEET 4 OF 4

					DRILLING START	DRILLING FINISH
WATER LEVEL					TIME	TIME
TIME					16:35	11:00
DATE					DATE	DATE
CASING DEPTH					3/25/95	3/25/95

DRILL RIG CME 75 - TRUCK MOUNT
ANGLE -90° BEARING
SAMPLE HAMMER

SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
46	6 8 12 16	1.6'/2.0' (80%)			(44.2-49.0 Ft.) Compact, olive gray (5Y 4/1), Fine SAND, trace silt, wet, NR, (SM), (ALLUVIUM)	SP (23)	
47	3 5 50/4"	1.1'/2.0' (55%)					
48						SP (24)	
49					(410.3) 49.0 End of Soil Borehole Log at 49.0 ft.		Top of weathered bedrock encountered @ 48.5 Ft.
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							

DRILLING CONTR LAYNE-WESTERN

LOGGED BY S. CISIO CHK'D BY W. HERST

DATE 6/1/95

JOB NO.: 243-2849

FILENAME: PZ205AS

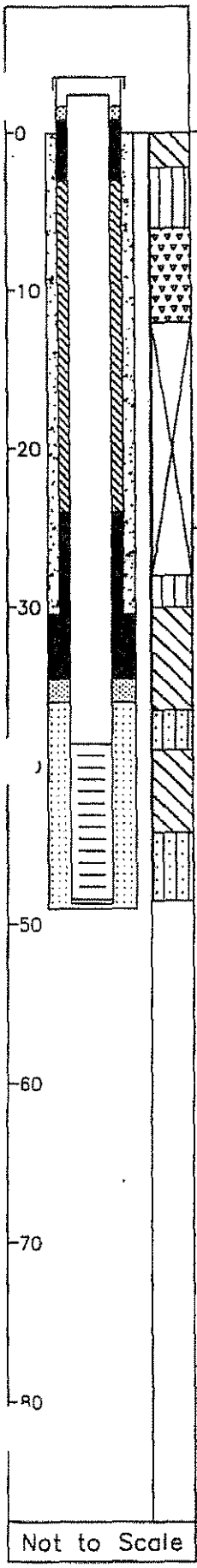
Well No. PZ-205-AS

Boring No. X-Ref: PZ-205-AS

PIEZOMETER CONSTRUCTION SUMMARY

Survey Coords: Northing: 1067464 ft.
Easting: 515463 ft.

Elevation Ground Level 459.3 ft. NGVD
Top of PVC Casing 460.99 ft. NGVD



Not to Scale

Drilling Summary:

Total Depth 49.0 ft.
Borehole Diameter 14 1/4 in. (0.0–29.0 ft.) 8 1/4 in. (29.0–49.0 ft.)
Casing Stickup Height 1.66 ft.
Driller Layne-Western
St. Louis, MO

Rig CME 75, Schramm Portadrill T660H
Bit(s) 6 1/4 in. and 10 1/4 in. ID Hollow Stem Auger Bits
Drilling Fluid Auger-None

Protective Casing 8x8 in. Square Steel, by 5 ft. long

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ____
Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 1.66	-	38.55	C1	460.99	-	420.78
38.55	-	48.35	S1	420.78	-	410.98
48.35	-	48.68	C2	410.98	-	410.65
+ 0.70	-	29.00	C3	460.00	-	430.33
	-				-	
	-				-	

Casing: C1 2 in. dia. Schedule 80 PVC, flush threaded with O-rings
C2 2 in. dia. threaded PVC end cap (4 in. long or 0.33 ft.) (C3-see comments)
Screen: S1 2 in. dia. Schedule 80 PVC, 0.010 in. machine cut slot, flush threaded with O-rings
Sand Pack: 16-35 mesh Silica Sand, 36.0-49.0 ft.
Filter Pack: Less than 50 mesh Silica Sand, 34.5-36.0 ft.
Grout Seal: Wyo-Ben Grout Well Bentonite Slurry, 3.0-24.0 ft., Neat cement, 3.0-29.0 ft.
Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry, 24.0-34.5 ft.
Concrete: 0.0-3.0 ft.

Construction Time log:

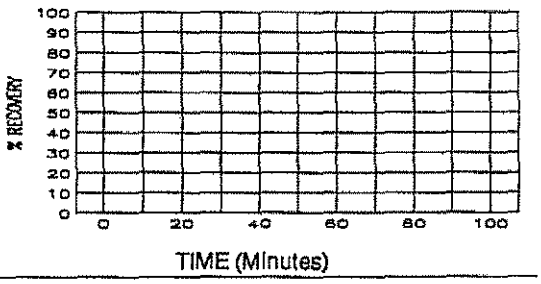
Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
CME 75	3/25/95	16:35	3/25/95	11:00
CME 75	4/21/95	14:10	4/21/95	15:30
CME 75	5/5/95	13:30	5/5/95	15:30
Geophys.Logging:				
Casing:				
2" PVC	5/5/95	16:00	5/5/95	16:05
10" Steel	4/21/95	15:29	4/21/95	16:30
Filter Placement:	5/5/95	16:05	5/5/95	16:45
Cementing:				
Development				
Bentonite Grout	5/5/95	17:00	5/5/95	17:30
Bentonite Seal	5/5/95	16:45	5/5/95	17:00

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments: Surface Casing C3: 10 in. ID / 10 7/8 in. OD Steel Casing

Supervised by B. Tilton
Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO
File Name PZ205AS

OFFICE USE ONLY	DATE RECEIVED
REF NO 122496	CHECK NO
ROUTE	TRANSMITTAL NO
STATE WELL NUMBER	CROSS REFERENCE NO
CHECKED BY	ENTERED Ph 1 Ph 2 Ph 3
APPROVED BY	DATE APPROVED

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

INFORMATION SUPPLIED BY OWNER

SITE NAME		WELL NUMBER	
LAIDLAW BRIDGETON SANITARY LANDFILL		PZ-205AS	
SITE ADDRESS: ST. CHARLES ROCK RD.	CITY: BRIDGETON	STATE: MO.	ZIP CODE: 63044
NAME: LAIDLAW WASTE SYSTEMS, INC.		TELEPHONE: 314-241-3710	
ADDRESS: 1838 N. BROADWAY	CITY: ST. LOUIS	STATE: MO	ZIP CODE: 63102

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

LOCATION OF WELL
SHOW LOCATION IN SECTION PLAT

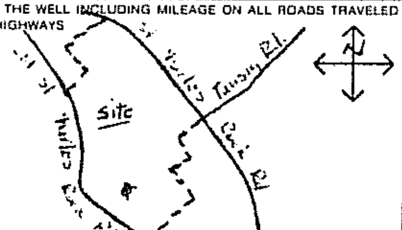
COUNTY: ST. LOUIS
ELEVATION: 457.3
AREA NO.

SMALLEST ¼ ____ ¼ ____ ¼ ____ ¼ ____ ¼ LARGEST ¼

SEC. ____ TWN. 47 N.RNG. 5 (E) OR W

LAT. 38 ° 45 ' 55 " LONG. 90 ° 26 ' 45 "

SKETCH THE LOCATION TO THE WELL INCLUDING MILEAGE ON ALL ROADS TRAVELED FROM NEAREST TOWNS OR HIGHWAYS



DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT

MONITORING WELL INSTALLATION CONTRACTOR'S NAME
LAYNE WESTERN CO, INC.

DRILLING CONTRACTOR'S NAME
LAYNE WESTERN CO, INC.

NOTE: Record the fraction of a foot in decimal, not in inches.

LOCKING CAP - (Y) N (Circle one)
CAP VENT (Y) N (Circle one)
Top of Riser Elevation: 461.0

PROTECTIVE CASING
Type: STEEL
Size: 8"x8"x5'
Bore Hole Diameter: 14"
WEEP HOLE - Y / (N) (Circle one)

Ground Surface Elevation: 457.3 Ft

Information in this column to be supplied in the Feet from Surface column

	Feet from Surface	Description of Formation
		0-2 clay
		2-6 silt
Depth to bottom of Protective Casing Seal:	4.0	
		6-27 Trash
Depth to Base of Annular Seal:	24.0	
		27-31 silt
Depth to Base of Bentonite Seal:	34.5	
Depth to Base of Secondary Filter Pack:	36.0	31-38 clay
Depth to Top of the Screen:	38.4	
		38-49 silt w/ sand
Depth to Bottom of the Screen:	48.4	
Plug Back Total Depth		
Original Total Depth:	49.0	

PROTECTIVE CASING SEAL
Type: ☒ Concrete ☐ Cement Slurry

RISER PIPE
Length: 40.1'
Diameter: 2"
Type of Material: SCH. 80 PVC

BOREHOLE DIAMETER: 8 In.

ANNULAR SEAL
Type: ☒ Bentonite Slurry ☒ Cement Slurry ☐ Non Slurry Bentonite

BENTONITE SEAL
Type: ☒ Bentonite Slurry ☐ Non Slurry Bentonite
Length of Seal: 10.5 Ft.

SECONDARY FILTER PACK (Optional)
Type: ☒ Sand ☐ Manufactured
Grain Size: < 50
Length: 1.5'

PRIMARY FILTER PACK
Type: ☒ Sand ☐ Manufactured
Grain Size: 16-35
Length: 13'

WELL SCREEN
Length: 10
Slot Size: 0.010"
Type: SCH. 80 PVC

SUMP DETAILS
Length: 0.3 Ft.
Diameter: 2 In.
Type: PVC

TYPE OF BACKFILL: SAND

TYPE OF INSTALLATION
☒ ABOVE GROUND ☐ FLUSH MOUNT

STATIC WATER LEVEL
FEET FROM MEASURING POINT

DATE OF STATIC WATER LEVEL

ELEVATION OF MEASURING POINT
461.0

MEASURING POINT IS
☒ TOP OF RISER PIPE
☐ OTHER

DRILLING EQUIPMENT
☐ AIR ROTARY ☒ AUGER TYPE 4¼ H.S.A.
☐ REVERSE ROTARY ☐ OTHER

CENTRALIZERS USED
☒ YES, AT 2 TOTAL
☒ STAINLESS STEEL
☐ OTHER
☐ NO

MULTIPLE CASED WELLS
SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.

DATE WELL CONSTRUCTION WAS COMPLETED
5-06-95

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE (MONITORING WELL CONTRACTOR) [signature]
PERMIT NUMBER 001258WPM DATE 6-02-95

SIGNATURE (DRILLING CONTRACTOR) [signature]
PERMIT NUMBER 001258WPM DATE 6-02-95

DISTRIBUTION: WHITE DIVISION CANARY MONITORING WELL CONTRACTOR PINK/OWNER

Drilling Log

Project Name: WESTLAKE						Boring No.: D-81	
Project No.: 84-075-4-002						Page: 1 of 4	
Ground Elevation: 447.8	Location: N. 1196.2728, E. 922.8145					Total Footage: 61.5'	
Drilling Type: SEE REMARKS	Hole Size: SEE REMARKS	Overburden Footage: 61.5	Bedrock Footage: 0	No. of Samples: 11	No. Core Boxes: 0	Depth To Water: SEE REMARKS	Date Measured: —
Drilling Co.: WABASH DRILLING CO.				Driller (s): DORL THORNTON			
Drilling Rig.: ACKER MP-5, TRUCK				Type of Penetration Test: STANDARD			
Date: 8-13-84 To 8-15-84				Field Observer (s): GLEN ERNSTMANN			

Depth	Description	Class.	Blow Count	Recov.	Sample or Box No.	Remarks
1	BROWN FINE SANDY SILT, LOW PLASTICITY, DAMP (FILL)					5" SOLID AUGERS 0' TO 15'
2						
3	GRAY-BROWN COARSE GRAVEL (MAX. 2" DIA.), SOME FINE GRAVEL AND SAND, DAMP (FILL)					
4						
5						
6						
7	BROWN CLAYEY SILT, LOW PLASTICITY, DAMP TO MOIST (FILL)					
8						
9						
10	BROWN FINE TO MEDIUM SAND, MEDIUM DENSE TO LOOSE, DAMP (FILL)				10.0	
11			5/5/4	16" / 18"	SS-1	
	BROWN CLAYEY SILT, LOW PLASTICITY, MOIST (FILL)				11.5	STOPPED 8-13-84
12						RESUMED 8-14-84
13	BROWN SILTY FINE TO MEDIUM SAND, MEDIUM DENSITY, SATURATED BELOW APPROX. 13'. (FILL?)					SATURATED MATERIAL FIRST ENCOUNTERED @ APPROX. 13'

TECHNICAL SERVICES
GEOTECHNICAL DEPARTMENT

Drilling Log (continued)

Boring No. D-81

Project Name: WESTLAKE — Page 2 of 4

Project No.: 84-075-4-002 — Date: 8-13-84

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
15	BROWN SILTY FINE TO MEDIUM SAND, MEDIUM DENSE SATURATED BELOW APPROX. 13' (FILL(?)		3/5/7	19"/18"	5.0 SS-2 6.5	BEGAN 4½" DIA. TRI-CONE, WASH BORING @ 15'. CONTINUED TO 61.5'.
16						
17						
18	BROWN FINE TO MEDIUM SAND, WELL SORTED, SUBROUNDED GRAINS, MEDIUM DENSITY, SATURATED					
19						
20			6/10/16	10"/18"	20.0 SS-3 21.5	
21						
22						
23						
24						
25			9/14/15	10"/18"	25.0 SS-4 26.5	
26						
27						
28	GRAY FINE SAND, TRACE SILT, SAND IS MICHLY QUARTZOSE, MEDIUM DENSE, SATURATED					
29						
30			10/12/5	11"/18"	30.0 SS-5a	

TECHNICAL SERVICES
GEOTECHNICAL DEPARTMENT

Drilling Log (continued)

Boring No. D-81
Page 3 of 4
Project Name WESTLAKE
Project No. 84-075-4-002
Date 8-13-84

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
32	GRAY SILTY CLAY MEDIUM TO HIGH PLASTICITY, STIFF TO MEDIUM STIFF, MOIST TO SATURATED				SS-5	
33				31.5		
34	GRAY SILT AND SAND INTERBEDS, SILT IS LOW PLASTICITY, VERY LOOSE, SATURATED					
35			*0/1/4	*0" / 18"	35.0 SS-6	*NOTE: RODS SUNK 6" WHEN SAMPLE SS-6 WAS FIRST ATTEMPTED; NO RECOVERY ON FIRST ATTEMPT SO RODS WERE DROPPED BACK DOWN THE HOLE AND A SAMPLE OBTAINED.
36					36.5	
37						
38						
39						
40					40.0	
41				18" / 18"	ST-7	Q_p = N.A.
42	GRAY FINE TO COARSE SD, SUBANGULAR TO SUBROUND GRAINS, HIGHLY QUARTZ, SATURATED				41.5	
43						
44	GRAY SAND AND GRAVEL MIX, SATURATED					
45					45.0	
46	GRAY COARSE SAND, SOME MEDIUM AND FINE, SUBROUND TO SUBANGULAR, DENSE		15/20/18	7" / 18"	SS-8	
47					46.5	
	(SEE DESCRIPTION BELO					

TECHNICAL SERVICES
GEOTECHNICAL DEPARTMENT

Drilling Log (continued)

Boring No. D-81
Project Name WESTLAKE
Page 4 of 4
Project No. 84-075-4-002
Date 8-13-84

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss	Box or Sample No.	Remarks
49	GRAY SAND AND FINE GRAVEL INTERBEDS, SAND IS FINE TO COARSE, SUBROUNDED, QUARTZOSE					
50	GRAVEL IS SUBANGULAR TO SUBROUNDED, QUARTZ, FELDSPAR AND SOME MAFIC MINERALS,		15/18/22	10"/18"	50.0 SS-9	← GRAVEL
51	DENSE TO VERY DENSE, SATURATED				SS-9a	← SAND
52					51.5	
53						
54						
55					55.0	
56			13/21/37	9"/18"	SS-10	A 2" dia. PVC piezometer was installed to 60'.
57					56.5	PVC is flush-joint, threaded couplings.
58						Bottom 15' is .010" machine slotted screen.
59	GRAY-BROWN FINE TO MEDIUM SAND, VERY DENSE, SATURATED					Bottom 17.5' is gravel packed with a 3' thick bentonite pellet seal above.
60					60.0	
61			19/20/44	8"/18"	SS-11	Annulus is grouted from seal to ground surface.
62	TOTAL DEPTH: 61.5'				61.5	T.O.P. is 3' above ground surface.
63						WATER LEVEL IS @ 14.43' BELOW T.O.P. 3:05pm 8-15-83 Cal hrs. after installation
64						

Drilling Log

Project Name: WESTLAKE						Boring No.: D - 87	
Project No.: 84-075-4-002						Page: 1 of 7	
Ground Elevation: 460.0	Location: N 114.45', E. 903.6487					Total Footage: 111.7	
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. of Samples	No. Core Boxes	Depth To Water	Date Measured
SEE REMARKS	5" @ THE SURFACE	111.0	0.7	22	0	SEE REMARKS	—

Drilling Co.: WABASH DRILLING CO.		Driller (s): DORL THORNTON	
Drilling Rig.: ACKER MP-5, TRUCK		Type of Penetration Test: STANDARD	
Date: 8-9-84	To: 8-10-84	Field Observer (s): GLEN ERNSTMANN	

Depth	Description	Class.	Blow Count	Recov.	Sample or Box No.	Remarks
1	LIGHT BROWN FINE TO COARSE SAND, SOME SILT AND GRAVEL, DAMP (FILL)					5" SOLID AUGERS 0' TO 30.0'
2	LIGHT GRAY GRAVEL (2" MAX. DIA.) SOME SAND, VERY DENSE, DAMP (FILL)					
3						
4						
5			50/3"	2"/3"	5.0 SS-1	
6	MOTTLED LIGHT GRAY TO DARK GRAY TO BROWN SANDY SILTY CLAY, MEDIUM PLASTICITY, STIFF, MOIST (FILL) TRACE GRAVEL (2" MAX. DIA.)					
7						
8						
9						
10			2/3/4	12"/12"	10.0 SS-2	
11						
12					11.5	
13						

Drilling Log, continued

Project Name: WESTLAKE	Boring No. D-87
Project No. 84-075-4-002	Page 2 of 7
	Date 8-9-84

Depth	Description	Log or Class	Blow Counts	Core Recov. & Loss		Box or Sample No.	Remarks
15	MOTTLED LIGHT GRAY TO DARK GRAY TO BROWN SANDY, SILTY CLAY, MEDIUM PLASTICITY, STIFF MOIST (FILL				15.0		
16	TRACE GRAVEL (2" MAX. DIA.)			23"/24"		ST-3	Q_p = 1.5 TSF
17					17.0		
18							
19	— — — — — —						
20	DARK GRAY SILTY CLAY, MEDIUM TO HIGH PLASTICITY, VERY STIFF, MOIST				20.0		
21				21"/24"		ST-4	Q_p = 2.75 TSF
22					22.0		
23	— — — — — —						
24	DARK GRAY SANDY SILT AND SILTY SAND INTERBEDS, SAND IS FINE TO MEDIUM, LOW TO NON-PLASTIC, WET TO SATURATED						
25					25.0		
26				4"/24"		ST-5	Q_p = N.A.
27					27.0		SATURATED MATERIAL FIRST ENCOUNTERED @ APPROXIMATELY 27.0' BELOW G.S.
28							
29	— — — — — —						
30	BROWN TO GRAY-BROWN SILTY FINE SAND, MEDIUM DENSE SATURATED, SLIGHTLY MICACEOUS		5/7/8	10"/18"	30.0	SS-6	

Drilling Log, continued

Boring No. D-87
Project Name WEST LAKE
Page 3 of 7
Project No. 84-075-4-002
Date 8-9-84

Depth	Description	Log or Class	Blow Counts	Core Recov. & Len		Test or Sample No.	Remarks
32	BROWN TO GRAY-BROWN SILTY FINE SAND, MEDIUM DENSE SATURATED				31.5	SS-6	NOTE: HOLE COLLAPSED TO 26.7' AFTER SAMPLE ST-6 WAS OBTAINED. NO FREE WATER OCCURS ABOVE THIS DEPTH.
33	SLIGHTLY MICACEOUS						
34							
35	BROWN FINE TO MEDIUM SAND, TRACE SILT, HIGHLY QUARTZOSE, DENSE, SATURATED		12/14/20	4"/18"	36.0	SS-7	BEGAN ROTARY WASH BORING W/ 4½" DIA. TRI-CONE BIT @ 30.0'
36					36.5		
37							
38	LIGHT BROWN FINE TO COARSE SAND INTERBEDDED WITH THIN (3" TO 10" THICK) GRAVEL SEAMS, TRACE SILT, DENSE TO VERY DENSE, SATURATED						
39					40.0		
40			15/25/25	8"/18"		SS-8	
41					41.5		
42							
43							
44							
45					45.0		
46			17/23/14	8"/18"		SS-9	
47					46.5		

Drilling Log, continued

Boring No. B-87
Project Name WEST LAKE
Page 4 of 7
Project No. 84-075-4-002
Date 8-9-84

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
49	LIGHT BROWN FINE TO COARSE SAND INTERBEDDED WITH THIN (3" TO 10" THICK) GRAVEL SEAMS, TRACE SILT, DENSE TO VERY DENSE, SATURATED						
50			12/29/50	10"/10"	50.0		
51						S3-10	
52					51.5		
53	GREENISH DARK GRAY FINE TO MEDIUM SAND, TRACE SILT, DENSE TO VERY DENSE, SATURATED						
54							
55					55.0		
56			12/17/23	3"/18"		S3-11	
57					57.5		
58							
59							
60					60.0		
61			33/35/50/4"	12"/18"		S3-12	
62					61.5		
63							
64							

Drilling Log, continued

Boring No. D-87
Project Name WESTLAKE
Page 5 of 7
Project No. 84-075-4-002
Date 8-9-84

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
66	GREENISH DARK GRAY FINE TO MEDIUM SAND, TRACE SILT, DENSE TO VERY DENSE, SATURATED		24/25/34	12"/18"	65.0	SS-13	
67					66.5		STOPPED 8-9-84 RESUMED 8-10-84
68							
69							
70			30/23/24	14"/18"	70.0	SS-14	
71					71.5		
72							
73							
74							
75	GRAY TO DARK GREENISH GRAY FINE TO COARSE SAND, HIGHLY QUARTZOSE, SUBROUNDED GRAINS, VERY DENSE TO MEDIUM DENSE, SATURATED FEW THIN (3" TO 6") GRAVEL SEAMS		27/29/34	14"/18"	75.0	SS-15	
76					76.5		
77							
78							
79							
80					80.0		
81			27/37/26	11"/18"		SS-16	
					81.5		

Drilling Log, continued

Boring No. D-87
Project Name: WESTLAKE
Page 6 of 7
Project No.: 84-075-4-002
Date: 8-7-84

Depth	Description	Log or Class	Blows Content	Core Recov. & Loss		Box or Sample No.	Remarks
83	GRAY TO DARK GREENISH GRAY FINE TO COARSE SAND, HIGHLY QUARTZOSE SUBROUNDED GRAINS, VERY DENSE TO MEDIUM DENSE, SATURATED						
84							
85	FEW THIN (3" TO 6" THICK) GRAVEL SEAMS AT INTERVALS OF 1' TO 5'.		15/10/14	9"/18"	RCD		
86						SS-17	
87					86.5		
88	NOTE: SAND IS PREDOMINANTLY COARSE WITH TRACE FINE GRAVEL THROUGHOUT BELOW APPROXIMATELY 88'.						
89							
90					90.5		
91			15/17/22	8"/18"		SS-18	
92					91.5		
93							
94							
95					95.0		
96			19/15/18	7"/18"		SS-19	
97					96.5		
98							

LOG OF TEST BORING NO.: F-2

CLIENT: LAIDLAW/BRIDGETON
PROJECT: AUG 90 WELL INSTALL
PROJECT NUMBER: 89L46
LOCATION:

SURFACE ELEVATION:
BORING DEPTH: 25.0
DATE: 9-3-90

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	FIELD INSTRUMENTS	DRILLING AND SAMPLING NOTES
0.0	--0						Top is Brown (10YR 5/3) silt with some sand & clay; turns to Brown lean CLAY w/ silt later dk. brown (10YR 3/3); Grey v.f. SAND layer (lift ?) at 2.0'. See some crushed white limestone gravel at 4.5'	FILL	TIP = 9.4 ppm maximum	Underground utility running nearby approx. 15' (?). Organics/sewer like odor noticed.
		0-5	SB	1	-	2.8				
-5.0	--5									
		5-10	SB	2	-	4.8	Brown (10YR 4/3) lean CLAY with little silt & trace of gravel; Bottom 1' is mottled brown, yell-brown(10YR 5/6) & grey (2.5YR 4/0) lean CLAY.	cl	TIP = 2.3 ppm max.	
-10.0	--10									
		10-15	SB	3	-	0.0	No recovery.	--?--	EXP = 28% LEL	First notice strong petroleum & lighter fluid like odors @ approx 13'
-15.0	--15							ml	TIP = 220 ppm from cuttings RAD = 0 mR/hr	
		15-20	SB	4	-	2.8	Dark Grey (2.5YR 4/0) SILT w/ some v.fine sand and some stratified CLAY layers (<2") 2" clay layer at 17.8'. Silt gradually coarsening to a v.f. SAND w/ little silt.	----- cl -----	TIP = 471 ppm max.	Water added to lower EXP. level.
-20.0	--20									
		20-25	SB	5	-	2.7	Dark Grey (2.5YR 4/0), f. to v.f. clean SAND; very stiff.	sp	TIP = 930 ppm max.	Strong gasoline like odor.
-25.0	--25						E.O.B. = 25.0'	-----		
-30.0	--30									
-35.0	--35									
-40.0	--40									
-45.0	--45									
-50.0	--50									

DRILLING DATA
START DATE: 8/9/90
COMPLETION DATE: 8/9/90
LOGGED BY: LDA
DRILLING METHOD: 4-1/4" I.D. HSA's
DRILLING CONTRACTOR: BROTCKE ENGR.

WATER LEVEL INFORMATION
DEPTH AT COMPLETION: 13.5'
LATER TIME/DEPTH: 15 hrs / 14.9'
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

Foth & Van Dyke

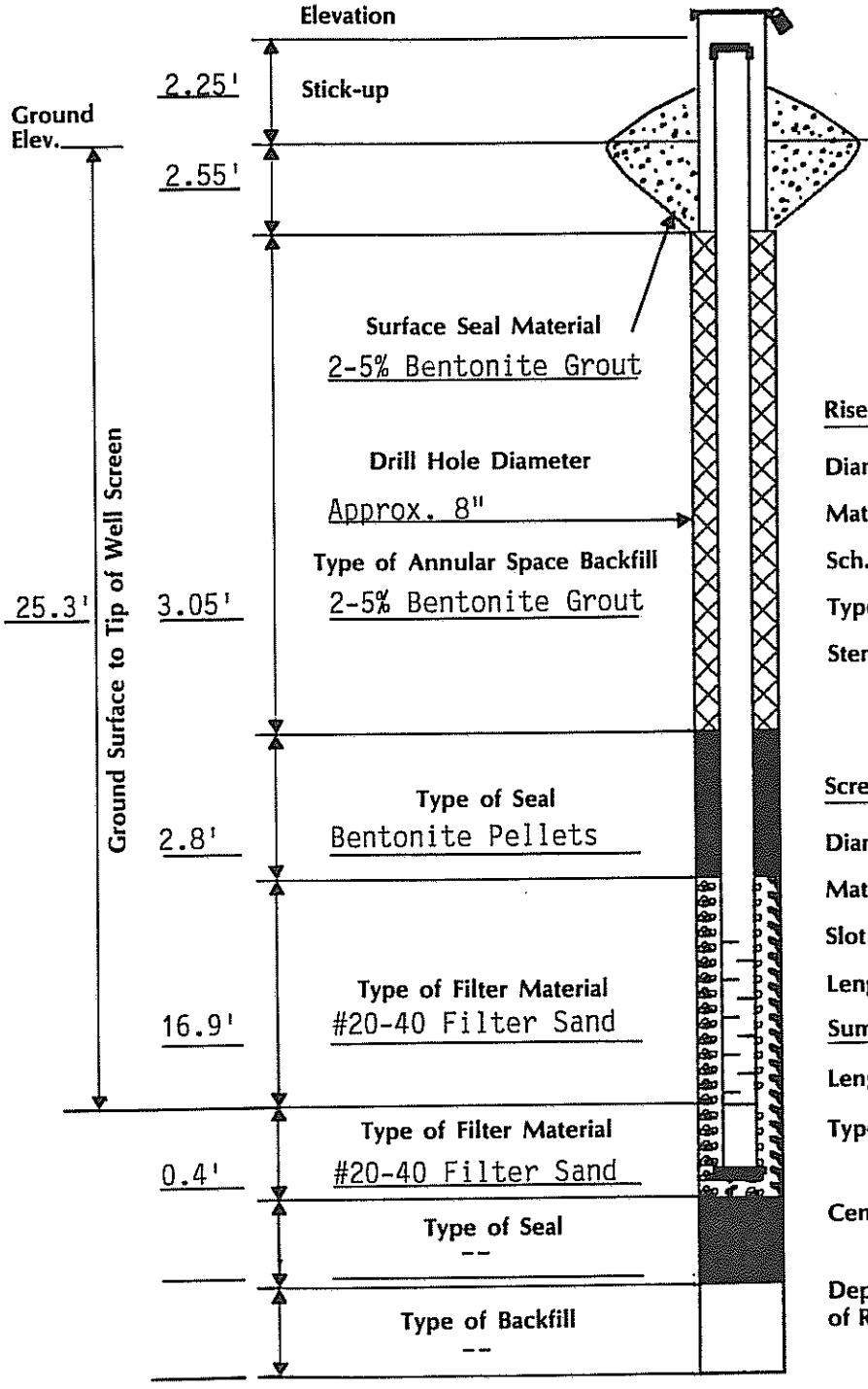
DTW = 16.73 from PVC Top

Client: Laidlaw/Bridgeton — Scope I.D.: 89L46-21
Project: 8/90 Well Installation — Page: 1
Prepared by: L.D. Aughenbaugh — Date: 8/10/90
Checked by: R.T. Bloese — Date: 9/6/90

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Mike Foppe of Brotcke Engineering — Well No.: F-2
Drilling Method: 4 1/4" I.D. HSA's — Date Installed: 8/10/90

Coordinates: --



Protector Pipe:
Size: 6" x 6" x 5'
Material: Steel
Lock No.: --

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? NO

Screen:
Diameter: 2"
Material: PVC
Slot Size: 10 slot
Length: 15 feet

Sump:
Length: 5"
Type of Cap: Point sump

Centralizer: Used ☐ Not Used ☒

Depth to Water From Top of Riser at Completion: 14'

NOTE: Not to Scale

Soil Boring Log

McLaren Hart

Boring No.	Project No./Name	Page:
I-9 WL-229	07.0803035.003.002	1 of 2

Start/Finish Date	**Site Name and Location**
9/18/95	West Lake Landfill; Bridgeton, Missouri
Drilling Contractor	**Boring Location:** Area 2
Hart Environmental Drilling	**Ground Surface Elevation:** 448.5
Driller	**Northing:** 1069329.26
Max Tinnin	**Easting:** 514268.59

Drilling Equipment	**McLaren/Hart Geologist/Office**
CME-55 Drill Rig, Hollow Stem Augers	Tim Biggs / St. Louis

Bit Size/Type	Sample Method	T.D. Borehole	Well Installed?
4 1/4" ID; 8 1/4" Hole	5' Continuous Sampler	55.6'	I-9

Remarks:

Depth (ft)	Sample ID #	Geiger Reading (mR/hr)	Description
5	WL-229 5	Background (0.01-0.04)	0.0-5.0' Landfill Debris: soil consisting of brown silt, and asphalt; no trashy debris encountered; dry.
10	None Taken	Background (0.01-0.04)	5.0-56.0' Native Alluvium: dark gray, silty, fine-grained sand grading to coarse-grained sand with gravel; moist to wet.
15	None Taken	Background (0.01-0.04)	
20	WL-229 20'	Background (0.01-0.04)	@ 16' wet
25	WL-229 25'	Background (0.01-0.04)	
30	WL-229 30'	Background (0.01-0.04)	
35	None Taken	None Taken	
40	None Taken	None Taken	
45	None Taken	None Taken	
50	None Taken	None Taken	

Soil Boring Log

McLaren Hart

Boring No.	Project No./Name	Page:
I-9 WL-229	07.0803035.003.002	2 of 2

Start/Finish Date	Site Name and Location
9/18/95	West Lake Landfill; Bridgeton, Missouri
Drilling Contractor	**Boring Location:** Area 2
Hart Environmental Drilling	**Ground Surface Elevation:** 448.5
Driller	**Northing:** 1069329.26
Max Tinnin	**Easting:** 514268.59

Drilling Equipment	McLaren/Hart Geologist/Office
CME-55 Drill Rig, Hollow Stem Augers	Tim Biggs / St. Louis

Bit Size/Type	Sample Method	T.D. Borehole	Well Installed?
4 1/4" ID; 8 1/4" Hole	5' Continuous Sampler	55.6'	I-9

Remarks:

Depth (ft)	Sample ID #	Geiger Reading (uR/hr)	Description
55	None Taken	None Taken	50.0-55.6' Native Alluvium: dark gray, silty, fine-grained sand grading to coarse-grained sand with gravel; moist to wet.
60	None Taken	None Taken	Boring terminated @ 55.6'

Notes:

Radiological samples collected at 5 and 20 feet below ground surface.

Non-radiological samples not collected during boring activities.

Perched water not encountered during boring activities.

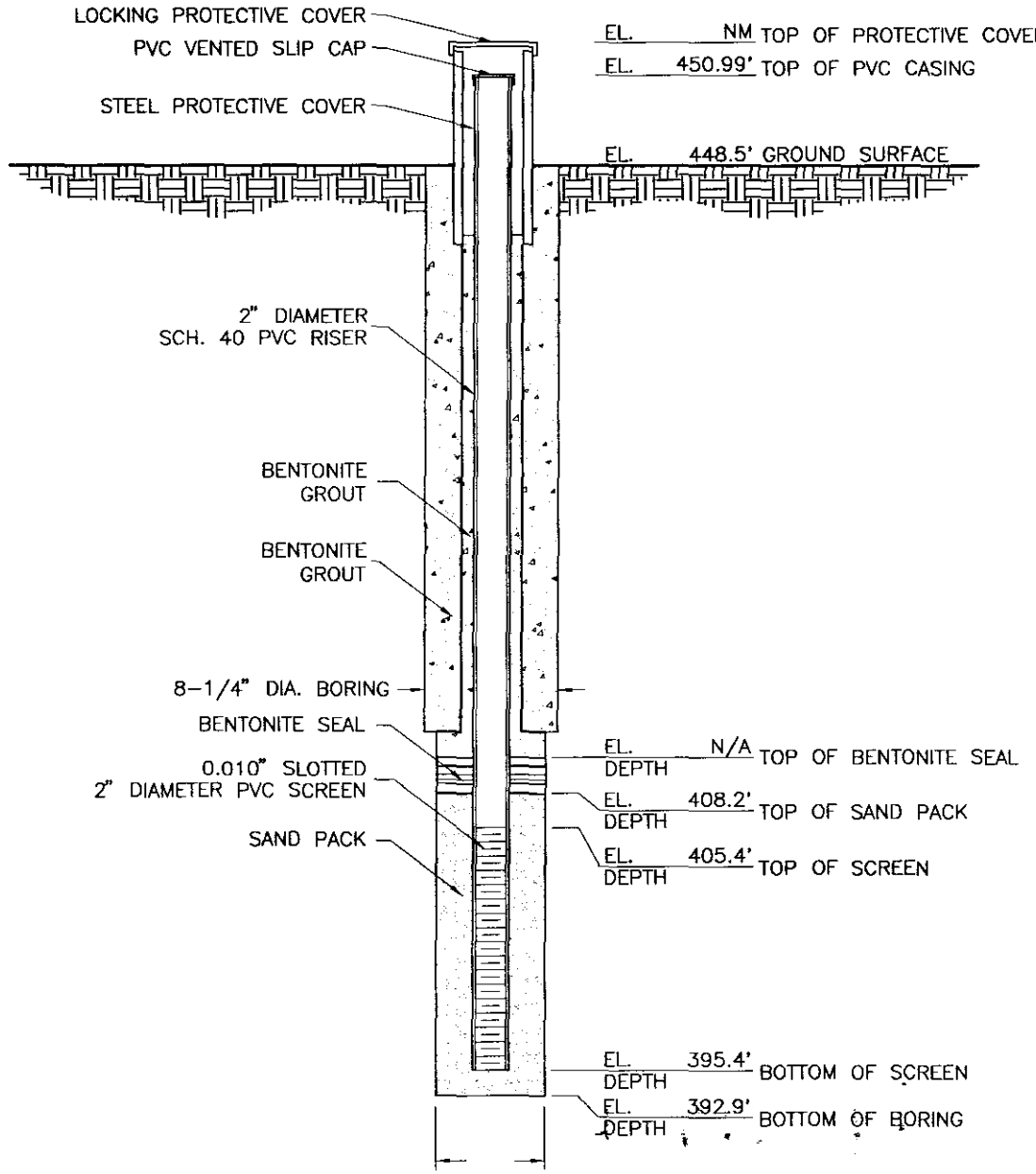
Groundwater encountered at 16 feet below ground surface.

McLaren Hart
ENVIRONMENTAL ENGINEERING CORPORATION

MONITORING WELL DETAILS

PROJECT NO. 070803035
WELL NO. I-9

PROJECT NAME WEST LAKE LANDFILL
WELL LOCATION BRIDGETON, MISSOURI DATE 9/18/95 BY HART ENVIRONMENTAL DRILLING



NOTES:

1. REFER TO SOIL BORING WL-229 FOR SOIL DESCRIPTION.
2. DETAIL NOT TO SCALE.
3. NM = NOT MEASURED.
4. N/A = NOT APPLICABLE; BENTONITE GROUT USED TO SEAL WELL UP TO SURFACE.

(W9)

SUBSURFACE EXPLORATION DA

by

WABASH DRILLING COMPANY

110 Angelica St. • St. Louis, Mo. 63147 • 421-2460

Boring No. 38
Coordinates Sheet 1 of 2
Surf. Elev.
Gr. Water Elev. --

Date of Drilling:
Started 6-22-78
Finished 6-23-78

Client Westlake Quarry & Material Co.

Job Name Westlake Landfill Client's Job No.

Job Location St. Charles Rock Road City Bridgeton State Mo.

Casing O.D. ____ I.D. ____ Sampler O.D. 2" I.D. 1-3/8"

Casing Hammer ____ lbs. ____ fall Sampler Hammer 140 lbs. 30" fall

W. D. Co. Foreman Gary Johanning Client's Inspector

Depth Below Ground Surface	Blows On Casing	Sample Number	Blows On Sampler	Penetration (If Sampler (inches)	FIELD IDENTIFICATION OF SOIL (Include relative firmness, relative moisture, color, mention all soil constituents, etc.)	REMARKS
					Trash & white chat	Used 6" H.S. auger
1'6"					White chat 1" minus	
7'0"					Moist, yellowish-tan, medium stiff clay	
13'0"					Moist, brown, firm, silty-clay with traces of fine sand	
19'0"					Moist, gray, medium stiff, plastic clay with traces of rust stains	
26'6"					Moist to wet, brown, loose, fine sand with traces of gravel	
31'0"					Wet, gray, medium dense, fine sand	(Cont'd.)

SUBSURFACE EXPLORATION D A

by

WABASH DRILLING COMPANY

110 Angelica St. • St. Louis, Mo. 63147 • 421-2460

Boring No. 38
Coordinates Sheet 2 of 2
Surf. Elev.
Gr. Water Elev. --

Date of Drilling:
Started 6-22-78
Finished 6-23-78

Client Westlake Quarry & Material Co.

Job Name Westlake Landfill Client's Job No.

Job Location St.Charles Rock Road City Bridgeton State Mo.

Casing O.D. I.D. Sampler O.D. 2" I.D. 1-3/8

Casing Hammer lbs. fall Sampler Hammer 140 lbs. 30" fall

W. D. Co. Foreman Gary Johanning Client's Inspector

Depth Below Ground Surface	Blows On Casing	Sample Number	Blows On Sampler	Penetration Of Sampler (inches)	FIELD IDENTIFICATION OF SOIL (Include relative firmness, relative moisture, color, mention all soil constituents, etc.)	REMARKS
					Wet, gray, medium dense, fine sand	Set bottom of well point @ 50'0" and back filled with ½" minus rock.
50'0"					Total depth of boring 50'0"	

DRILLING LOG

McLaren Hart

SB/MW #: I-73
Log #:
Page 1 of 2
Geoscientist:

PROJECT: Westlake
PROJECT #: 11.0800556
LOCATION: Bridgeton, Missouri
TOC ELEVATION: 462.6
SAMPLING DATE(S): 6/22/78 6/23/78
START:
FINISH:
SAMPLING METHOD:
MONITORING DEVICE:
SUBCONTRACTOR/EQUIPMENT:
DRILLING METHOD:
NOTES:

Depth Below Surface (ft.)	Sampler Interval/ Recovery	Sample ID #	PID reading (ppm)	Soil Description Color, Texture, Moisture, Etc.	Unified Classification	Graphic Log	Well Construction Details
0				TRASH & white CHAT (FILL)			
2				CHAT; white, 1" minus			
4							
6							
8				CLAY; yellowish tan, med stiff, moist			
10							
12							
14				Silty CLAY; tr fine Sand, brown, firm, moist	CL ML		
16							
18							
20				CLAY; gray, med stiff, tr rust stains, moist			
22							
24							
26							
28				SAND; brown, loose, fine, tr Gravel	SM GM		
30							
32							
34							
36				SAND; gray, med dense, fine, wet			
38							
40							
42							
44							
46							
48							
50				See Following Page...			

SIGNATURE OF FIELD SUPERVISOR

Assistant Geoscientist
TITLE

SIGNATURE OF REVIEWER

Project Manager
TITLE

DRILLING LOG

McLaren Hart

SB/MW #: I-73
Log #:
Page 2 of 2
Geoscientist:

PROJECT: Westlake PROJECT #: 11.0800556

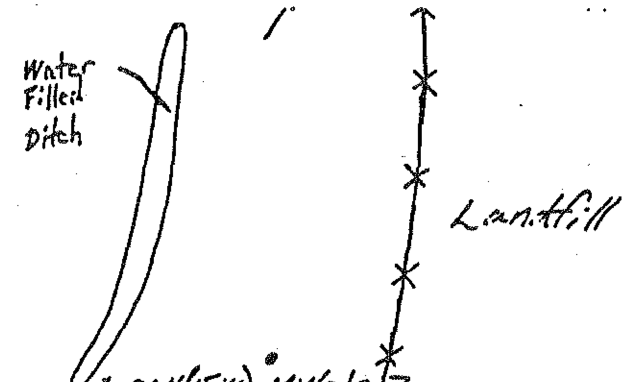
Depth Below Surface (ft.)	Sampler Interval/ Recovery	Sample ID #	PID reading (ppm)	Soil Description Color, Texture, Moisture, Etc.	Unified Classification	Graphic Log	Well Construction Details
50.0				Total depth = 50.0'			

SIGNATURE OF FIELD SUPERVISOR

Assistant Geoscientist
TITLE

SIGNATURE OF REVIEWER

Project Manager
TITLE



DRILLING METHOD:	3¾" Hollow Stem Augers
SAMPLING METHOD:	3" I.D. Continuous Sampler
BORING NO.	MW-103
SHEET	1 of 2

WATER LEVEL	7'			
TIME				
DATE				
CASING DEPTH				

DRILLING	START	FINISH
TIME	11:30	
DATE	04/09	04/09

DATUM (380N/15W) MW-103 ELEVATION

SURFACE CONDITIONS: Grassy Topsoil

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO. / SAMPLE DEPTH	BLOWS/FT. SAMPLER	HNU	DEPTH IN FEET	SOIL GRAPH	DESCRIPTION
CS	60" / 48"		1 / 0'			0		
					0	1	ML	Dark brown, med stiff, slightly moist clay silt, high organic content
						2		
						3		
						4		Gray, med stiff, fine silt with trace of clay
						5		
CS	60" / 60"		2 / 5'			6		
					0	7	▽	Moist gray, med stiff to stiff fine silt w/ traces of sand
						8		
						9		
						10		
CS	60" / 42"		3 / 10'			1	SM	Very moist, gray, fine sand with silt, very soft and runny
					0	2		
						3		
						4		
						5		
CS	36" / 36"		4 / 15'			6		
					0	7		
						8		
						9	EOB-18'	
						20		

Well construction notes:

Steel Prot Casing

2.7'

2' Dia. Pad

2.5'

Bentonite Pellets

4.5'

Sand: WB-35
Well: 2" Dia PVC
Screen: #10 Slot Size PVC

Sand

(From Top of PVC) 18.4'

10006354

W/E 35

CHK'D BY

DATE

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION _____

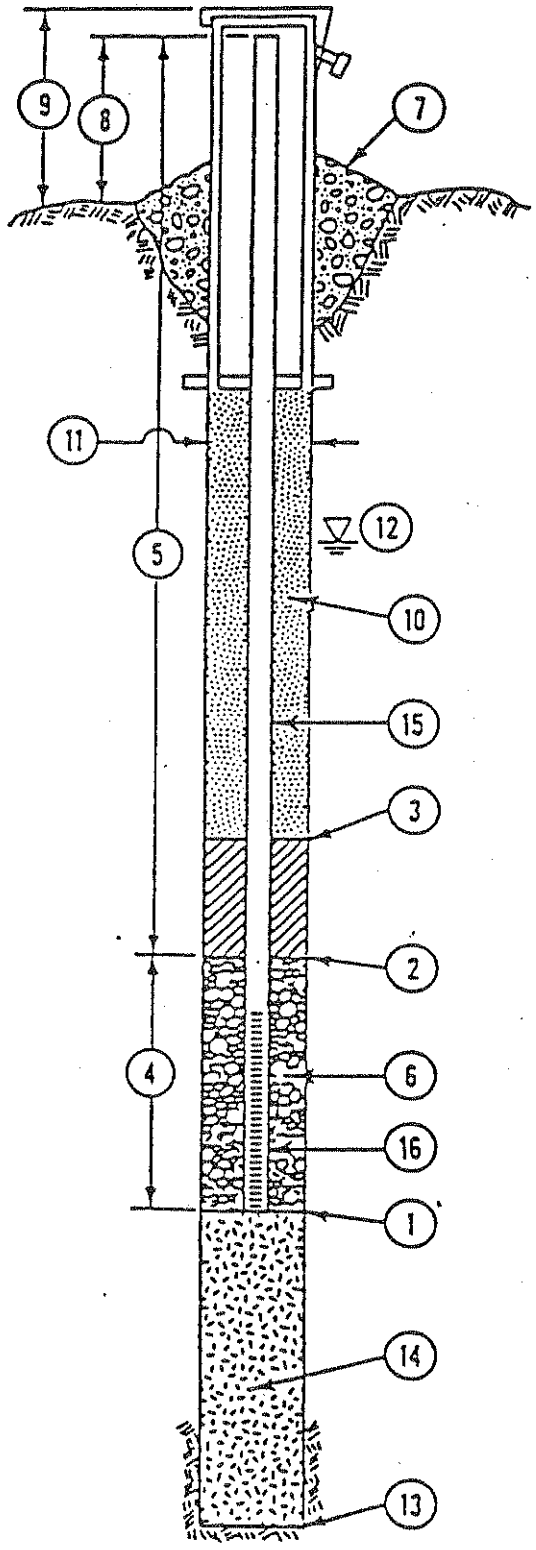
TOP OF WELL CASING ELEVATION 441.16

JOB NUMBER 19943-002

BORING NUMBER MW-103

DATE 04/09/90

LOCATION Earth City, MO



1. DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 15.7 FEET.*
2. DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 4.5 FEET.* Bentonite Pellets
3. DEPTH TO TOP OF SEAL (IF INSTALLED) 2.5 FEET.*
4. LENGTH OF WELL SCREEN 10 FEET. SLOT SIZE 0.010.
5. TOTAL LENGTH OF PIPE 8.4 FEET AT 2 INCH DIAMETER.
6. TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE sand.
7. CONCRETE CAP. (YES) NO (CIRCLE ONE)
8. HEIGHT OF WELL CASING ABOVE GROUND 2.7 FEET.
9. PROTECTIVE CASING? (YES) NO (CIRCLE ONE) HEIGHT ABOVE GROUND 2.8 FEET. LOCKING CAP? (YES) NO (CIRCLE ONE)
10. TYPE OF UPPER BACKFILL cement slurry
11. BOREHOLE DIAMETER 8 INCHES.
12. DEPTH TO GROUND WATER 7 FEET.*
13. TOTAL DEPTH OF BOREHOLE 18 FEET.*
14. TYPE OF LOWER BACKFILL Natural sand + silt
15. PIPE MATERIAL PVC.
16. SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

10006362

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

Landfill

Old St. Charles Rock Rd

culvert

MW104

ditch

(40N/15E)

DRILLING METHOD:	3 3/4" ID Hollow Stem Auger
SAMPLING METHOD:	3" ID Continuous Sampler 5' Length
WATER LEVEL	7'
TIME	
DATE	
CASING DEPTH	

BORING NO. MW-104

SHEET 1 of 1

DRILLING START	DRILLING FINISH
TIME 8:20	TIME 9:00
DATE 4-11-90	DATE

DATUM

ELEVATION

SAMPLER TYPE	INCHES DRIVEN / INCHES RECOVERED	DEPTH OF CASING	SAMPLE NO. / SAMPLE DEPTH	BLOWS/FT. SAMPLER	NUMBER OF RINGS	DEPTH IN FEET	SOIL GRAPH
CS	60/48		1/0-5			00	
						1	
						2	
						3	
						4	
CS	60/48		2/5-10			05	
						6	
						7	
						8	
						9	
CS	60/12		3/10-15			10	
						1	
						2	
						3	
						4	
CS	24/30		4/15-17			15	
						6	
						17	
						8	
						9	
						0	

SURFACE CONDITIONS:

Grassy Topsoil

moist dark brown topsoil silt

sandy silt

Medium to light brown stiff fine silt

Medium brown to grey silt w/ black and rust particles

Medium brown stiff silty clay

Medium brown fine silt w/ rust stains

stiff Medium brown stiff silt

dark grey fine sand

EOB 17'

1CC06353

CHKD BY

LINE

MONITOR WELL INFORMATION SHEET

GROUND SURFACE ELEVATION _____

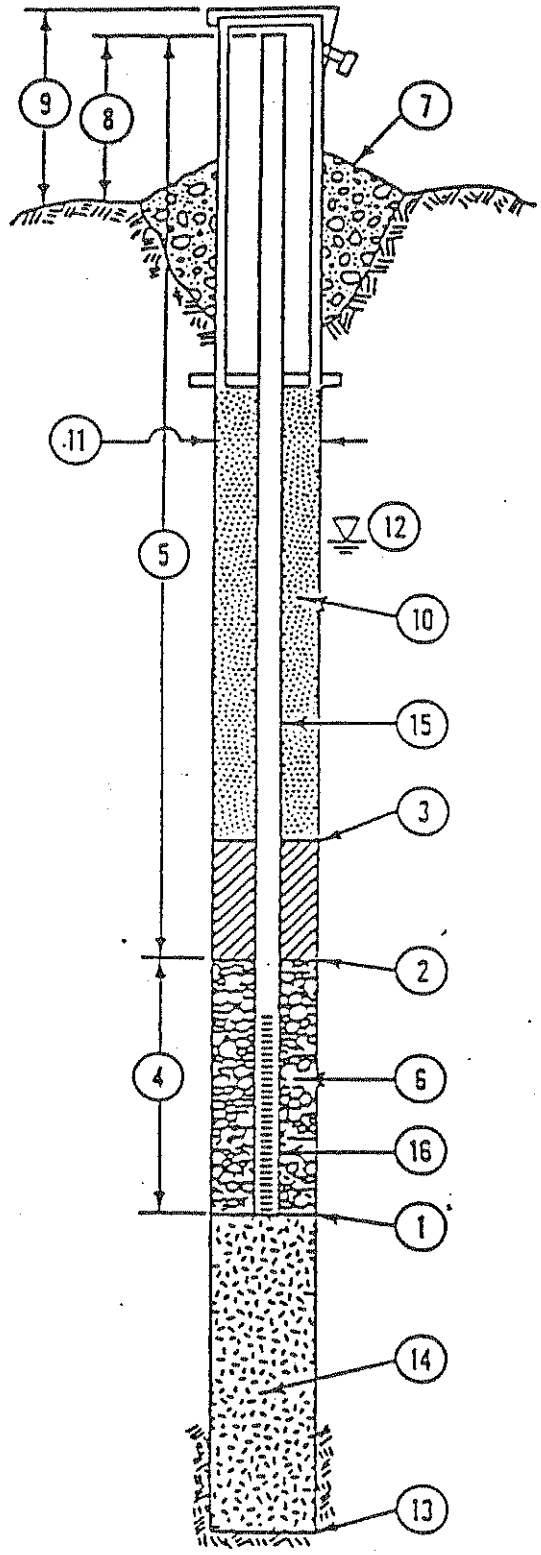
TOP OF WELL CASING ELEVATION 441.88

JOB NUMBER 19943-002

BORING NUMBER MW-104

DATE 4-11-90

LOCATION Earth City MO



(1) DEPTH TO BOTTOM OF WELL POINT OR SLOTTED PIPE 17 FEET.*

(2) DEPTH TO BOTTOM OF SEAL (IF INSTALLED) 5 FEET.* Bentanite Pellets

(3) DEPTH TO TOP OF SEAL (IF INSTALLED) 2.3 FEET.*

(4) LENGTH OF WELL SCREEN 10 FEET.
SLOT SIZE 0.010.

(5) TOTAL LENGTH OF PIPE 9.9 FEET AT 2 INCH DIAMETER.

(6) TYPE OF PACK AROUND WELL POINT OR SLOTTED PIPE SAND.

(7) CONCRETE CAP. (YES) NO (CIRCLE ONE)

(8) HEIGHT OF WELL CASING ABOVE GROUND 2.9 FEET.

(9) PROTECTIVE CASING? (YES) NO (CIRCLE ONE)
HEIGHT ABOVE GROUND _____ FEET.
LOCKING CAP? (YES) NO (CIRCLE ONE)

(10) TYPE OF UPPER BACKFILL Cement.

(11) BOREHOLE DIAMETER 8 INCHES.

(12) DEPTH TO GROUND WATER 7 FEET.*

(13) TOTAL DEPTH OF BOREHOLE 17 FEET.*

(14) TYPE OF LOWER BACKFILL N/A.

(15) PIPE MATERIAL PVC.

(16) SCREEN MATERIAL PVC.

*(DEPTH FROM GROUND SURFACE)

10006361

MONITOR WELL INSTALLATION DETAILS

Dames & Moore

RECORD OF DRILLHOLE PZ-205-SS

Sheet 1 of 4

PROJECT: LAIDLAW/RI-FS
PROJECT NO: 943-2848
LOCATION: BRIDGETON, MO

BORING METHOD: NX Core & water
DRILLING DATE: 5/17/95 - 5/19/95
DRILL RIG: CME 75

DATUM: MSL
COORDINATES N: 1067483.54
AZIMUTH: 0

COLLAR ELEV: 459.5
E: 515477.78
INCLINATION: -90

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough
Fe-FeOxide, CL-Clay Infill, CH-Chlorite, H-Healed, GRF-Gravel Filled

DEPTH SCALE (FEET)	ROCK TYPE DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: DIP w/r CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX: SW FR, MW, HW, CW	STRENGTH INDEX: R6, R5, R4, R3, R2, R1	POINT LOAD INDEX (psi): R1 30, R2 150, R3 300, R4 600, R5 1500, R6	TEST ORIENTATION	NOTES WATER LEVELS INSTRUMENTATION
48	0.0-49.0 ft. See Soil Borehole Log PZ-205-AS 49.0-54.0 ft. No samples collected														0.0-49.0 ft. Borehole advanced with 10.25 in. ID hollow stem augers 49.0-54.0 ft. Borehole advanced with 9 7/8 in. bit using mud rotary then 6 in. steel casing grouted into annulas with neat cement Bedrock encountered @ 48.5 ft.
50															
52															
54	405.50 54.00 54.0-67.5 ft. Fresh, medium to thinly bedded, pale yellowish brown (10YR 6/2), very fine grained, weak, ARGILLACEOUS LIMESTONE, (ST. LOUIS FORMATION)		405.50 54.00												5/18/95 @ 8:15 Began coring
56				1	93%				J,PL,SM,Fe						
58									J,PL,SM J,ST,SM J,C,SM,Fe						
	400.50 59.00		400.10 59.40						B,PL,SM						5/18/95 @ 8:40 End of Run 1
60															
62	62.3-69.5 ft. Grain size is medium grained			2	89%				J,PL,SM (2)						
64									J,PL,SM						

DEPTH SCALE: 1:2
DRILLING CONTRACTOR: LAYNE-WESTERN
DRILLER: D. MAHURIN

LOGGED: D. ALLOWAY
CHECKED: B. TILTON
DATE: 6/20/95

Golder Associates

RECORD OF DRILLHOLE PZ-205-SS

Sheet 2 of 4

PROJECT: LAIDLAW/RI-FS
PROJECT NO: 943-2848
LOCATION: BRIDGETON, MO

BORING METHOD: NX Core & water
DRILLING DATE: 5/17/95 - 5/19/95
DRILL RIG: CME 75

DATUM: MSL
COORDINATES N. 1087483.54
AZIMUTH: 0

COLLAR ELEV: 459.5
E: 515477.78
INCLINATION: -90

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Slikensided, SM-Smooth, R-Rough, VR-V. Rough
Fe-FeOxide, CL-Clay Infill, CH-Chlorite, H-Healed, GRF-Gravel Filled

SCALE (Feet)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: DIP wrt CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	TEST ORIENTATION	NOTES, WATER LEVELS, INSTRUMENTATION
64	54.0-67.5 ft. Fresh, medium to thinly bedded, pale yellowish brown (10YR 6/2), very fine grained, weak, ARGILLACEOUS LIMESTONE, (ST. LOUIS FORMATION) 65.0-75.9 ft. Scattered chert nodules 65.8-66.0 ft. Claystone layer								J,PL,R B,PL,SM (2) J,PL,SM,Fe		SW FR MW HW CW	R5 R4 R3 R2 R1	R2 150 R3 300 R4 600 R5 1500 R6		
66				2	99%										
68	67.5-99.5 ft. Fresh, medium to thinly bedded, pale yellowish brown (10YR 6/2), very fine grained, weak, LIMESTONE, (ST. LOUIS FORMATION) Stylolitic		390.10						J,PL,R,Fe						5/18/95 @ 10:40 End of Run 2
70	69.8-75.9 ft. Very fine to microcrystalline zones of thinly laminated layers of clay within the limestone, color is medium light gray (N6)		69.40						J,PL,R J,PL,R (2) J,I,R						
72				3	100%				J,PL,R J,I,R						
74			385.00						J,I,R (3)						5/18/95 @ 11:45 End of Run 3 Ended drilling for the day due to bad weather. 5/19/95 @ 7:40 Began drilling
			74.50						J,PL,R						
76	76.6-77.4 ft. Argillaceous layer			4	100%				J,PL,R,Fe J,PL,R J,PL,R						
78	78.7-80.0 ft. Argillaceous zone, unfilled vugs (1-3 mm. in diameter)								J,I,R J,PL,R J,PL,R (2)						
80															

DEPTH SCALE: 1:2
DRILLING CONTRACTOR: LAYNE-WESTERN
DRILLER: D. MAHURIN

LOGGED: D. ALLOWAY
CHECKED: B. TILTON
DATE: 6/20/95

Golder Associates

RECORD OF DRILLHOLE PZ-205-SS

PROJECT: LAIDLAW/RI-FS
PROJECT NO: 943-2846
LOCATION: BRIDGETON, MO

BORING METHOD: NX Core & water
DRILLING DATE: 5/17/95 - 5/19/95
DRILL RIG: CME 75

DATUM: MSL
COORDINATES N: 1087483.54
AZIMUTH: 0

COLLAR ELEV: 459.5
E: 515477.78
INCLINATION: -90

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough
Fe-FeOxide, CL-Clay Infill, CH-Chlorite, H-Healed, GRF-Gravel Filled

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO.	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: DIP wrt CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	GRAPHIC LOG	WEATHERING INDEX	STRENGTH INDEX	POINT LOAD INDEX (psi)	TEST ORIENTATION	NOTES WATER LEVELS INSTRUMENTATION
80	67.5-99.5 ft. Fresh, medium to thinly bedded, pale yellowish brown (10YR 6/2), very fine grained, weak, LIMESTONE. (ST. LOUIS FORMATION) Stylolitic								J,PL,R (2)						
82	81.8-86.4 ft. Argillaceous zone, unfilled vugs, (1-3 mm. in diameter)			4	100%				J,PL,R						
84									J,PL,R						5/19/95 @ 9:15 End of Run 4
	84.5-86.4 ft. Color grades to light olive gray (5GY 6/1)		375.00 84.50						J,PL,R						
86									B,PL,SM						
									J,PL,SM						
									J,PL,SM						
									J,C,SM						
88									J,PL,R						
	88.6-93.8 ft. Argillaceous, vuggy, color is light olive gray (5GY 6/1)			5	100%										
90															
92									B,PL,SM						
94															5/19/95 @ 10:40 End of Run 5
	94.5-97.5 ft. Argillaceous, color is light olive gray (5GY 6/1)		365.00 94.50												
				6	100%				J,PL,SM						
96															

DEPTH SCALE: 1:2
DRILLING CONTRACTOR: LAYNE-WESTERN
DRILLER: D. MAHURIN

LOGGED: D. ALLOWAY
CHECKED: B. TILTON
DATE: 6/20/95

Golder Associates

RECORD OF DRILLHOLE PZ-205-SS

Sheet 4 of 4

PROJECT: LAIDLAW/RI-FS
PROJECT NO: 943-2648
LOCATION: BRIDGETON, MO

BORING METHOD: NX Core & water
DRILLING DATE: 5/17/95 - 5/19/95
DRILL RIG: CME 75

DATUM: MSL
COORDINATES N: 1087483.54
AZIMUTH: 0

COLLAR ELEV: 459.5
E: 515477.78
INCLINATION: -90

J-Joint, F-Fault, S-Shear, B-Bedding, F-Foliation
PL-Planar, C-Curved, U-Undulating, ST-Stepped, I-Irregular
P-Polished, K-Slickensided, SM-Smooth, R-Rough, VR-V. Rough
Fe-FeOxide, CL-Clay Infill, CH-Chlorite, H-Healed, GRF-Gravel Filled

DEPTH SCALE (FEET)	DESCRIPTION	GRAPHIC LOG	ELEV / DEPTH (FT)	RUN NO	CORE RECOVERY	RQD	FRACTURES PER FOOT	DISCONTINUITY DATA: DIP wrt CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA: GRAPHIC LOG	WEATHERING INDEX (SW FR, MW, HW, CW)	STRENGTH INDEX	POINT LOAD INDEX (psi)	TEST ORIENTATION	NOTES WATER LEVELS INSTRUMENTATION
96	67.5-99.5 ft. Fresh, medium to thinly bedded, pale yellowish brown (10YR 6/2), very fine grained, weak, LIMESTONE, (ST. LOUIS FORMATION) Stylolitic 97.5-99.5 ft. Thin clay laminae														
98				6	100 %				J,I,R,Fe						
									J,PL,SM,CL						
	360.00		360.00						J,I,R						5/19/95 @ 11:30 Finished drilling
	End of Record of Drillhole at 99.5 ft. 99.50		99.50												
100															
102															
104															
106															
108															
110															
112															

STRENGTH INDEX: R6, R5, R4, R3, R2, R1
POINT LOAD INDEX (psi): R6 1500, R5 600, R4 300, R3 150, R2 30, R1

DEPTH SCALE: 1:2
DRILLING CONTRACTOR: LAYNE-WESTERN
DRILLER: D. MAHURIN

LOGGED: D. ALLOWAY
CHECKED: B. TILTON
DATE: 6/20/95

Golder Associates

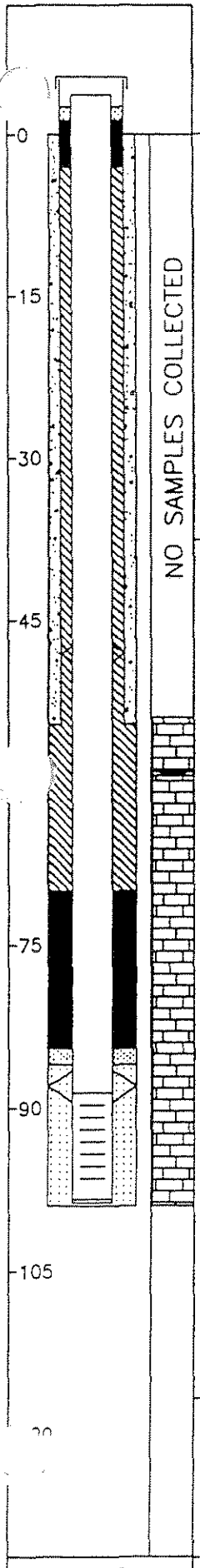
Well No. PZ-205-SS

Boring No. X-Ref: PZ-205-SS

PIEZOMETER CONSTRUCTION SUMMARY

Survey Coords: Northing: 1067484 ft.
Easting: 515478 ft.

Elevation Ground Level 459.5 ft. NGVD
Top of PVC Casing 461.78 ft. NGVD



Drilling Summary:

Total Depth 99.0 ft.
Borehole Diameter 9 3/4 in. (0.0-54.0 ft.) 5 7/8 in. (54.0-99.0 ft.)
Casing Stickup Height 1.66 ft.
Driller Layne-Western
St. Louis, MO

Rig CME 75, Schramm Portadrill T660H
Bit(s) 6 1/4 in. ID Hollow Stem Auger Bit, NX Core,
5 7/8 in. Button Bit and 9 3/4 in. Tricone Bit
Drilling Fluid Auger-None, NX Core Water,
Air and Mud Rotary
Protective Casing 8x8 in. Square Steel, by 5 ft. long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
CME 75	5/18/95	8:15	5/19/95	11:30
Schramm Rotary	5/21/95	13:30	5/21/95	14:30
Geophys.Logging:				
Casing:				
2" PVC	5/21/95	14:25	5/21/95	14:30
8" Steel	5/11/95	7:30	5/11/95	11:00
Filter Placement:	5/21/95	14:40	5/21/95	15:15
Cementing:				
Development				
Bentonite Grout	5/21/95	15:20	5/21/95	15:35
Bentonite Seal	5/21/95	15:15	5/21/95	15:20

Well Design & Specifications

Basis: Geologic Log X Geophysical Log
Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 1.66	-	88.57	C1	461.78	-	370.96
88.57	-	98.37	S1	370.96	-	361.16
98.37	-	98.70	C2	361.16	-	360.83
+ 1.00	-	54.00	C3	460.50	-	405.53
	-				-	
	-				-	

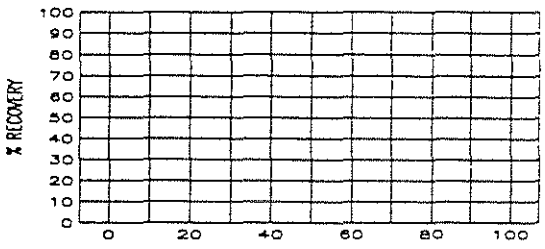
Casing: C1 2 in. dia. Schedule 80 PVC, flush threaded with O-rings
C2 2 in. dia. threaded PVC end cap (4 in. long or 0.33 ft.) (C3-see comments)
Screen: S1 2 in. dia. Schedule 80 PVC, 0.010 in. machine cut slot, flush threaded with O-rings
Sand Pack: 16-35 mesh Silica Sand, 86.0-99.0 ft.
Filter Pack: Less than 50 mesh Silica Sand, 84.5-86.0 ft.
Grout Seal: Wyo-Ben Grout Well Bentonite Slurry, 3.0-70.0 ft.
Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry, 70.0-84.5 ft.
Concrete: 0.0-3.0 ft.

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments: Surface Casing C3: 6 1/8 in. ID / 6 5/8 in. OD Steel Casing

Not to Scale

Supervised by W. Herst
Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO
File Name PZ205SS

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF NO 122506	CHECK NO.
ROUTE	TRANSMITTAL NO
STATE WELL NUMBER	CROSS REFERENCE NO
CHECKED BY	ENTERED Ph 1 Ph 2 Ph 3
APPROVED BY	DATE APPROVED

INFORMATION SUPPLIED BY OWNER

SITE NAME: LAIDLAW BRIDGETON SANITARY LANDFILL
WELL NUMBER: PZ-20555

SITE ADDRESS: 21. CHARLES ROCK RD. | CITY: BRIDGETON | STATE: MO | ZIP CODE: 63044

NAME: LAIDLAW WASTE SYSTEMS, INC. | TELEPHONE: 314-241-3710

ADDRESS: 1838 N. BROADWAY | CITY: ST. LOUIS | STATE: MO | ZIP CODE: 63102

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

LOCATION OF WELL
SHOW LOCATION IN SECTION PLAT

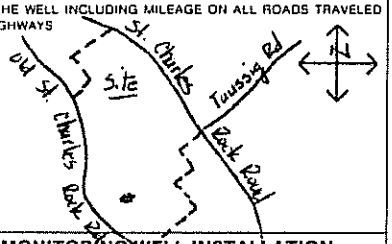
COUNTY: ST. LOUIS
ELEVATION: 454.5
AREA NO.:

SMALLEST ¼ / LARGEST ¼: ____ ¼ ____ ¼ ____ ¼ ____ ¼

SEC. ____ TWN. 47 N,RNG. 5 (E) OR W

LAT. 38 ° 45 ' 55 " LONG. 90 ° 26 ' 45 "

SKETCH THE LOCATION TO THE WELL INCLUDING MILEAGE ON ALL ROADS TRAVELED FROM NEAREST TOWNS OR HIGHWAYS



DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT

NOTE: Record the fraction of a foot in decimal, not in inches.

Top of Riser Elevation: 461.8

LOCKING CAP - (Y) N (Circle one)
CAP VENT - (Y) N (Circle one)

PROTECTIVE CASING
Type: STEEL
Size: 8" x 8" x 5'
Bore Hole Diameter: 9 7/8"
WEEP HOLE - Y / N (Circle one)

Ground Surface Elevation: 454.5 ft

Information in this column to be supplied in the Feet from Surface column	Feet from Surface	Description of Formation
Depth to bottom of Protective Casing Seal:	3.0	
		50-85 Limestone
Depth to Base of Annular Seal:	60.0	
Depth to Base of Bentonite Seal:	71.0	
Depth to Base of Secondary Filter Pack:	72.5	
Depth to Top of the Screen:	74.7	
Depth to Bottom of the Screen:	84.7	
Plug Back Total Depth:		
Original Total Depth:	85.0	

PROTECTIVE CASING SEAL
Type: [X] Concrete [ ] Cement Slurry

RISER PIPE
Length: 77'
Diameter: 2"
Type of Material: SCH. 80 PVC

BOREHOLE DIAMETER: 5 7/8 in.

ANNULAR SEAL
Type: [ ] Bentonite Slurry [X] Cement Slurry [ ] Non Slurry Bentonite

BENTONITE SEAL
Type: [X] Bentonite Slurry [ ] Non Slurry Bentonite
Length of Seal: 11 Ft.

SECONDARY FILTER PACK (Optional)
Type: [X] Sand [ ] Manufactured
Grain Size: #50
Length: 1.5'

PRIMARY FILTER PACK
Type: [X] Sand [ ] Manufactured
Grain Size: 16-35
Length: 12.5'

WELL SCREEN
Length: 10'
Slot Size: 0.010"
Type: SCH 80 PVC

SUMP DETAILS
Length: 0.3 Ft.
Diameter: 2 in.
Type: PVC

TYPE OF BACKFILL: SAND

MONITORING WELL INSTALLATION CONTRACTOR'S NAME
LAYNE WESTERN CO., INC.

DRILLING CONTRACTOR'S NAME
LAYNE WESTERN CO., INC.

TYPE OF INSTALLATION
[X] ABOVE GROUND [ ] FLUSH MOUNT

STATIC WATER LEVEL
FEET FROM MEASURING POINT

DATE OF STATIC WATER LEVEL

ELEVATION OF MEASURING POINT
461.8

MEASURING POINT IS
[X] TOP OF RISER PIPE
[ ] OTHER

DRILLING EQUIPMENT
[ ] AIR ROTARY [ ] AUGER TYPE
[ ] REVERSE ROTARY [ ] OTHER

CENTRALIZERS USED
[X] YES, AT 4 INTAL
[X] STAINLESS STEEL
[ ] OTHER
[ ] NO

MULTIPLE CASED WELLS
SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.

DATE WELL CONSTRUCTION WAS COMPLETED
5-21-95

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE (MONITORING WELL CONTRACTOR): Michael P. Vogt
PERMIT NUMBER: 001256 WIIM | DATE: 6-02-95

SIGNATURE (DRILLING CONTRACTOR): Michael P. Vogt
PERMIT NUMBER: 001256 WIIM | DATE: 6-02-95

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MD
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1067210.24
DATUM EASTING: 514720.49 ELEVATION 450.0

DRILLING METHOD:
4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger
3.625 inch Mud Rotary
SAMPLING METHOD: CALIFORNIA SAMPLER: 2.0" I.D. (CA)
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

BORING NO. PZ-302-AI

SHEET 1 OF 2

	DRILLING START	DRILLING FINISH
WATER LEVEL		
TIME	TIME 8:15	TIME 11:30
DATE	DATE 9/26/95	DATE 9/26/95
CASING DEPTH		

DRILL RIG CME 750
ANGLE 90° BEARING NA
SAMPLE HAMMER
SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
16					(0.0-22.0 ft.) No samples collected, see Soil Borehole Log PZ-302-AS for descriptions		
17							
18							
19							
20							
21							
22 (428.0)					22.0		
23	4 2 7 6	0.1' 2.0' (5%)			(22.0-25.4 ft.) Loose, pale yellowish brown (10YR 6/2), f-m SAND with trace iron staining, NR, wet, (SP), (ALLUVIUM)	SP 1	
24	3 2 3 10	1.2' 2.0' (60%)				SP 2	0.0 ppm PID
25							
26	10 7 9 14	1.6' 2.0' (80%)			(25.4-26.1 ft.) Compact, olive gray (5Y 4/1), f-m SAND, trace Silt, iron staining, NR, wet, (SP), (ALLUVIUM) (26.1-37.4 ft.) Compact to dense, light olive gray (5Y 4/1), f-m SAND, NR, wet, (SP), (ALLUVIUM)	SP 3	
27							
28	8 8 12 10	1.0' 2.0' (50%)				SP 4	
29							

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: PZ302AI

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD:	BORING NO.
	4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger	PZ-302-AI
	3.625 inch Mud Rotary	SHEET 2 OF 2
LAIDLAW/OU2 RI-FS/MO WEST LAKE LANDFILL OPERABLE UNIT 2	SAMPLING METHOD: CALIFORNIA SAMPLER: 2.0" I.D. (CA)	
	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)	DRILLING
	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)	START / FINISH
	WATER LEVEL	TIME / TIME
	TIME	8:15 / 10:30
	DATE	DATE / DATE
NORTHING: 1067210.24 DATUM EASTING: 514720.49 ELEVATION 450.0	CASING DEPTH	9/26/95 / 9/26/95

DRILL RIG CME 750	SURFACE CONDITIONS
ANGLE 90° BEARING NA	
SAMPLE HAMMER	

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
31	8 9 10 13	1.4'/2.0' (70%)			(26.1-37.4 Ft.) Compact to dense, light olive gray (5Y 4/1), f-m SAND, NR, wet, (SP), (ALLUVIUM)	SP (5)	
32	11 9 10 14	1.6'/2.0' (80%)				SP (6)	
33							
34	16 18 20 24	1.1'/2.0' (55%)				CA (7)	
35							
36	7 7 10 14	1.2'/2.0' (60%)				SP (8)	
37					(412.6) 37.4		
38	6 11 11 12	1.3'/2.0' (65%)			(37.4-42.0 Ft.) Compact, olive gray (5Y 4/1), well graded SAND, NR, wet, (SW), (ALLUVIUM)	SP (9)	
39							
40	10 14 14 12	1.3'/2.0' (65%)				SP (10)	
41							
42					(408.0) 42.0		0.0 ppm PID
43					End of Soil Borehole Log at 42.0 ft.		
44							

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON CHK'D BY B. TILTON

DATE 10/9/95

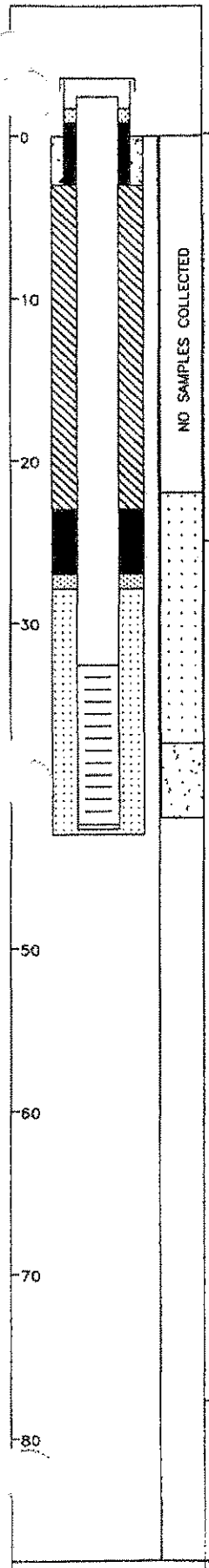
JOB NO.: 943-2848

FILENAME: PZ302AI

Well No. PZ-302-AI

Boring No. X-Ref: PZ-302-AI

PIEZOMETER CONSTRUCTION SUMMARY



Not to Scale

Survey Coords: Northing: 1067210 ft. Easting: 514720 ft.

Elevation Ground Level 450.0 ft. NGVD

Top of PVC Casing 451.15 ft. NGVD

Drilling Summary:

Total Depth 43.0 ft.

Borehole Diameter 8 1/4" (0.0-43.0')

Casing Stickup Height 1.15 ft.

Driller Layne-Western, St. Louis, MO

Rig CME 750

Bit(s) 4 1/4" ID Hollow Stem Auger Bit, 3 5/8" Tricone Bit

Drilling Fluid Bentonite Drilling Mud (20.0-42.0')

Protective Casing 8x8" Square Steel, by 5' long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling CME 750	9/26/95	8:15	9/26/95	11:30
Geophys.Logging:				
Casing: 2" I.D. PVC	9/26/95	12:50	9/26/95	12:55
Filter Placement:	9/26/95	13:05	9/26/95	13:40
Cementing:				
Development				
Bentonite Grout	9/26/95	14:00	9/26/95	14:15
Bentonite Seal	9/26/95	13:40	9/26/95	13:50

Well Design & Specifications

Basis: Geologic Log X Geophysical Log

Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 1.15	-	32.60	C1	451.15	-	417.40
32.60	-	42.40	S1	417.40	-	407.60
42.40	-	42.70	C2	407.60	-	407.30
	-				-	
	-				-	
	-				-	

Casing: C1 2" dia. Schedule 80 PVC, flush threaded with O-rings

C2 2" dia. threaded PVC end cap (4" long or 0.33')

Screen: S1 2" dia. Schedule 80 PVC, 0.010" machine cut slot, flush threaded with O-rings

Sand Pack: 16-35 mesh Silica Sand 27.9-43.0'

Filter Pack: 100 mesh Silica Sand 27.0-27.9'

Grout Seal: Wyo-Ben Grout Well Bentonite Slurry 3.0-23.0'

Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry 23.0-27.0'

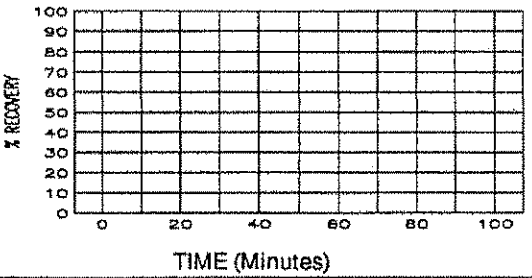
Concrete: 0.0-3.0'

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments:

Supervised by B. Harrington

Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO

File Name PZ302AI

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF. NO. 145100	
C.R. NO.	CHECK NO.
STATE WELL NUMBER	TRANSMITTAL NO.
CHECKED BY	ROUTE
APPROVED BY	ENTERED Ph 1 Ph 2 Ph 3

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

SITE/FACILITY NAME: LAIDLAW BRIDGETON SANITARY LANDFILL
WELL NUMBER: PZ-302AI
SITE ADDRESS: ST. CHARLES ROCK RD. | CITY: BRIDGETON | STATE: Mo | ZIP CODE: 63044
OWNER NAME: LAIDLAW WASTE SYSTEMS, INC. | TELEPHONE: 314-241-3710
OWNER ADDRESS: 1838 N. BROADWAY | CITY: ST. LOUIS | STATE: Mo | ZIP CODE: 63102

VARIANCE ISSUED ☐ YES ☒ NO | DATE ISSUED | VARIANCE NUMBER: V

DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT
15' INSIDE FENCE LINE, 720' NORTHWEST OF SOUTH ENTRANCE OFF OLD ST. CHARLES ROCK RD.

LOCATION OF WELL — SHOW LOCATION IN SECTION PLAT
COUNTY: ST. LOUIS
SURFACE ELEVATION: 450.5
SMALLEST ¼ ____ ¼ ____ ¼ ____ ¼ LARGEST ¼
SEC. ____ TWN. 47 N,RNG. 5 (E) OR W
LAT. 38 · 45 · 52 · LONG. 90 · 26 · 54 "

MONITORING WELL INSTALLATION CONTRACTOR'S NAME: LAYNE WESTERN Co, INC. | PERMIT NUMBER: 001258 WPM
DRILLING CONTRACTOR'S NAME: LAYNE WESTERN Co, INC. | PERMIT NUMBER: 001258 WPM

WELL CONSTRUCTION INFORMATION

TYPE OF WELL: ☐ MONITORING WELL ☒ PIEZOMETER ☐ OTHER ____
TYPE OF POTENTIAL SITE: ☐ HAZARDOUS MATERIAL ☒ LANDFILL ☐ OTHER ☐ L.U.S.T. ____
MONITORING FOR: (CHECK ALL THAT APPLY) ☒ V.O.C. ☐ METALS ☐ PETROLEUM PRODUCT ☐ OTHER ____ ONLY

PROTECTIVE CASING DETAILS (IF USED): LENGTH 5 FT. | DIAMETER OF CASING 8x8 IN. | WEIGHT OR SDR # 0.188" | DIAMETER AND DEPTH OF DRILL HOLE 8¼ IN. 43 FT. | JOINTS ☐ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER ____ | MATERIAL ☐ THERMO PLASTIC ☒ STEEL ☐ FLUORO POLYMER TYPE ____ | LOCKING CAP? ☒ YES ☐ NO

CASING GROUT DETAILS: CAP VENTED ☒ YES ☐ NO | WEEP HOLE? ☒ YES ☐ NO | MATERIAL ☐ CEMENT ☒ CONCRETE ☐ OTHER ____ | DEPTH FROM THE SURFACE TO THE BOTTOM OF THE CASING GROUT SEAL 3.0 FT. | TYPE OF SURFACE COMPLETION ☒ ABOVE GROUND ☐ FLUSH MOUNT | DESCRIBE HOW THE FLUSH MOUNT WAS CONSTRUCTED

CENTRALIZER USED ON RISER ☒ NO ☐ YES LOCATED AT ____ | MATERIAL ☐ STAINLESS STEEL ☐ OTHER ____

RISER PIPE DETAILS: LENGTH 34.2 FT. | DIAMETER OF RISER PIPE 2 IN. | WEIGHT OR SDR # SCH 80 | DIAMETER OF DRILL HOLE 8¼ IN. | JOINTS ☒ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER ____ | MATERIAL ☒ THERMO PLASTIC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER ____

ANNULAR SEAL: ☐ CEMENT SLURRY ☒ BENTONITE SLURRY ☐ NON SLURRY BENTONITE TYPE: ____ ☐ CEMENT/BENTONITE SLURRY BAGS OF CEMENT USED ____ % BENTONITE USED ____ WATER USED/BAG ____ GAL.

BENTONITE SEAL: MATERIAL BENTONITE ☒ SLURRY ☐ CHIPS ☐ GRANULAR ☐ PELLETS | LENGTH OF SEAL 4.0 | BENTONITE SEAL INSTALLED IN ☐ UNSATURATED ZONE ☒ SATURATED ZONE

PRIMARY FILTER PACK: TYPE ☒ SAND ☐ MANUFACTURED ☐ NATURAL | GRAIN SIZE 16-35 | LENGTH OF FILTER PACK 15.1 FT. | METHOD OF INSTALLATION HSA POUR

SECONDARY FILTER PACK: TYPE ☒ SAND ☐ MANUFACTURED ☐ NONE | GRAIN SIZE 100 | LENGTH OF FILTER PACK 0.9 FT. | METHOD OF INSTALLATION HSA POUR

WELL SCREEN: LENGTH OF SCREEN 10 FT. | DIAMETER 2 IN. | SLOT SIZE 10 | WEIGHT OR SDR # SCH 80 | MATERIAL ☒ PLASTIC ☐ STEEL ☐ FLUORO POLYMER

SUMP DETAILS: LENGTH OF SUMP | DIAMETER OF SUMP | MATERIAL ☐ PVC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER ____

BACK FILL: WAS THE WELL BACK FILLED? ☐ YES ☒ NO | MATERIAL USED | LENGTH OF BACK FILLED BORE HOLE

Information in this column to be supplied in the Feet from Surface column	FEET FROM SURFACE	FORMATION DESCRIPTION
Depth to bottom of Protective Casing Seal:	3.0	0-15 Silty clay
Depth to Base of Annular Seal:	23.0	15-43 Silty sand
Depth to Base of Bentonite Seal:	27.0	
Depth to Top of Primary Filter Pack:	27.4	
Depth to Top of the Screen:	33.0	
Depth to Bottom of the Screen:	43.0	
Total Depth:	43.0	
DATE WELL DRILLING WAS COMPLETED	9-26-95	

STATIC WATER LEVEL FEET FROM MEASURING POINT: ____
DATE OF STATIC WATER LEVEL: ____
MEASURING POINT FOR STATIC WATER LEVEL IS ☒ TOP OF RISER PIPE ☐ OTHER ____
ELEVATION OF MEASURING POINT: 451.15

MULTIPLE CASED WELLS: SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.

DRILLING EQUIPMENT: ☐ AIR ROTARY ☒ AUGER TYPE 4¼ H.S.A. ☐ REVERSE ROTARY ☐ OTHER ____

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE PRIMARY CONTRACTOR/PERMIT #	DATE	SIGNATURE DRILLER/PERMIT #	DATE
Tamara J. Mahurin M.	11-15-95	Tamara J. Mahurin M.	11-15-95

MO 780-1415 (7-95)

DISTRIBUTION: WHITE/DIVISION CANARY/MONITORING WELL CONTRACTOR PINK/OWNER
MAIL WHITE COPY TO: DEPARTMENT OF NATURAL RESOURCES, P.O. BOX 250, ROLLA, MO 65402
ENCLOSE $35 PER MONITORING WELL FOR THE CERTIFICATION FEE WITHIN 60 DAYS AFTER WELL COMPLETION

RECYCLED PAPER

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD:					BORING NO.
	4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger					PZ-302-AS
						SHEET
	SAMPLING METHOD: CALIFORNIA SAMPLER: 2.0" I.D. (CA)					1 OF 2
LAIDLAW/OU2 RI-FS/MO WEST LAKE LANDFILL OPERABLE UNIT 2	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)					DRILLING
	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)				START	FINISH
	WATER LEVEL	18 FT.			TIME	TIME
	TIME	14:00			11:45	14:35
	DATE	9/25/95			DATE	DATE
NORTHING: 1067197.73 DATUM EASTING: 514737.29 ELEVATION 449.5	CASING DEPTH	20 FT.			9/25/95	9/25/95

DRILL RIG CME 750 | SURFACE CONDITIONS

ANGLE 90° BEARING NA

SAMPLE HAMMER

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE		REMARKS
1	5 7 5 5	1.6' / 2.0' (80%)			(0.0-1.5 Ft.) Compact, dark yellowish orange (5YR 6/6), CLAYEY SILT, Fine Gravel sized pebbles, (FILL)	SP	1	
2	4 5 5 6	1.5' / 2.0' (75%)			(1.5-15.0 Ft.) Loose, olive gray (5Y 4/1), SILT, NR, dry to wet, some inter-mixed fill to 2.5 Ft., (SM), (LOESS)	SP	2	
3								
4		1.7' / 2.0' (85%)			@ 3.5 Ft., damp	ST	3	0.0 ppm PID
5								
6	1 1 1 2	1.9' / 2.0' (95%)			@ 6.7 Ft., moist	SP	4	
7								
8	0 0 0 1	1.9' / 2.0' (95%)				SP	5	
9								
10	1 2 2 2	1.4' / 2.0' (70%)				SP	6	0.0 ppm PID
11					From 11.5-11.7 Ft., wet From 11.7-13.1 Ft., moist			
12	1 2 1 4	2.0' / 2.0' (100%)				SP	7	
13					From 13.1-13.6 Ft., wet From 13.6-15.0 Ft., moist			
14	4 5 6 3	1.2' / 2.0' (60%)				SP	8	

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON CHK'D BY B. TILTON

DATE 10/9/95

JOB NO.: 943-2848

FILENAME: PZ302AS

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1067197.73
DATUM EASTING: 514737.29 ELEVATION 449.5

DRILLING METHOD:
4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD: CALIFORNIA SAMPLER: 2.0" I.D. (CA)
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

WATER LEVEL	18 FT.				
TIME	1400				
DATE	9/25/95				
CASING DEPTH	20 FT.				

BORING NO. PZ-302-AS

SHEET 2 OF 2

DRILLING

START	FINISH
TIME 1145	TIME 1435
DATE 9/25/95	DATE 9/25/95

DRILL RIG CME 750

ANGLE 90° BEARING NA

SAMPLE HAMMER

SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
16	1 9 8 6	1.5' 2.0' (75%)			(15.0-21.9 ft.) Loose, olive gray (5Y 4/1), medium SAND, NR, wet, (SP),(ALLUVIUM)	SP (8)	
17						CA (9)	
18	1 3 5 9	2.0' 2.0' (100%)					0.0 ppm PID
19					From 19.2-21.0 ft, trace to little Silt in Sand	SP (10)	
20	3 5 5 4	1.6' 2.0' (80%)					
21					(21.9-24.0 ft.) Loose, dark yellowish brown (10YR 6/2), F-m SAND, little iron staining, NR, wet, (ALLUVIUM)	SP (11)	
22	0 0 1 2	2.0' 2.0' (100%)					0.0 ppm PID
23						SP (12)	
24					(-24.0) 24.0		
25					End of Soil Borehole Log at 24.0 ft.		
26							
27							
28							
29							

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

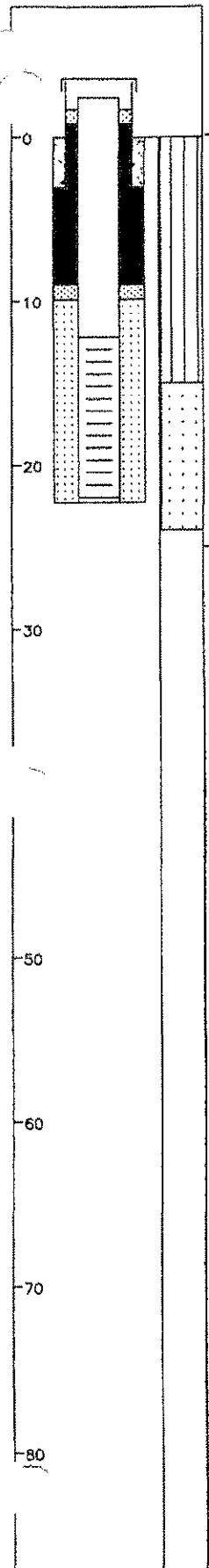
JOB NO.: 943-2848

FILENAME: PZ302AS

Well No. PZ-302-AS

Boring No. X-Ref: PZ-302-AS

PIEZOMETER CONSTRUCTION SUMMARY



Survey Coords: Northing: 1067198 ft. Easting: 514737 ft.

Elevation Ground Level 449.5 ft. NGVD

Top of PVC Casing 451.42 ft. NGVD

Drilling Summary:

Total Depth 22.3 ft.

Borehole Diameter 8 1/4" (0.0-22.3')

Casing Stickup Height 1.92 ft.

Driller Layne-Western, St. Louis, MO

Rig CME 750

Bit(s) 4 1/4" ID Hollow Stem Auger Bit

Drilling Fluid None

Protective Casing 8x8" Square Steel, by 5' long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
CME 750	9/25/95	11:45	9/25/95	14:35
Geophys.Logging:				
Casing:				
2" I.D. PVC	9/25/95	14:55	9/25/95	15:00
Filter Placement:	9/25/95	15:00	9/25/95	15:40
Cementing:				
Development				
Bentonite Grout Bentonite Seal	9/25/95	15:40	9/25/95	15:60

Well Design & Specifications

Basis: Geologic Log X Geophysical Log

Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 1.92	-	12.20	C1	451.42	-	437.30
12.20	-	22.00	S1	437.30	-	427.50
22.00	-	22.30	C2	427.50	-	427.20
	-				-	
	-				-	
	-				-	

Casing: C1 2" dia. Schedule 80 PVC, flush threaded with O-rings

C2 2" dia. threaded PVC end cap (4" long or 0.33')

Screen: S1 2" dia. Schedule 80 PVC, 0.010" machine cut slot, flush threaded with O-rings

Sand Pack: 16-35 mesh Silica Sand 9.9-22.3'

Filter Pack: 100 mesh Silica Sand 9.0-9.9'

Grout Seal:

Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry 3.0-9.0'

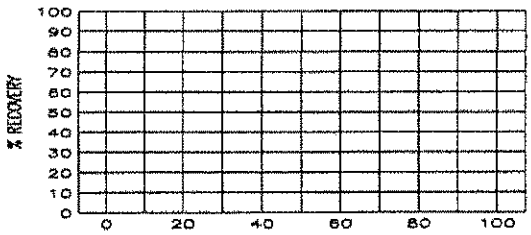
Concrete: 0.0-3.0'

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments:

Not to Scale

Supervised by B. Harrington

Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO

File Name PZ302AS

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF. NO. 145099	
C.R. NO.	CHECK NO.
STATE WELL NUMBER	TRANSMITTAL NO.
CHECKED BY	ROUTE
APPROVED BY	ENTERED Ph 1 Ph 2 Ph 3

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

SITE/FACILITY NAME: LAIDLAW BRIDGETON SANITARY LANDFILL
WELL NUMBER: PZ-302AS
SITE ADDRESS: ST. CHARLES ROCK RD.
CITY: BRIDGETON
STATE: Mo
ZIP CODE: 63044
OWNER NAME: LAIDLAW WASTE SYSTEMS, INC.
TELEPHONE: 314-241-3710
OWNER ADDRESS: 1838 N. BROADWAY
CITY: ST. LOUIS
STATE: Mo
ZIP CODE: 63102

VARIANCE ISSUED: ☐ YES ☒ NO
DATE ISSUED:
VARIANCE NUMBER: V

DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT
20' INSIDE FENCE LINE, 700' NORTHWEST OF SOUTH ENTRANCE OFF OLD ST CHARLES ROCK RD.

LOCATION OF WELL
SHOW LOCATION IN SECTION PLAT
COUNTY: ST. LOUIS
SURFACE ELEVATION: 449.2
SMALLEST ¼ ____ ¼ ____ ¼ LARGEST ¼ ____
SEC. ____ TWN. 47 N,RNG. 5 (E) OR W
LAT. 38 ° 45 ' 52 " LONG. 90 ° 26 ' 54 "

MONITORING WELL INSTALLATION CONTRACTOR'S NAME: LAYNE WESTERN Co, INC.
PERMIT NUMBER: 001258 WPM
DRILLING CONTRACTOR'S NAME: LAYNE WESTERN Co., INC.
PERMIT NUMBER: 001258 WPM

WELL CONSTRUCTION INFORMATION

TYPE OF WELL: ☐ MONITORING WELL ☒ PIEZOMETER ☐ OTHER
TYPE OF POTENTIAL SITE: ☐ HAZARDOUS MATERIAL ☒ LANDFILL ☐ OTHER ☐ L.U.S.T.
MONITORING FOR: (CHECK ALL THAT APPLY) ☒ V.O.C. ☐ METALS ☐ PETROLEUM PRODUCT ☐ OTHER ONLY

PROTECTIVE CASING DETAILS (IF USED):
LENGTH: 5 FT. | DIAMETER OF CASING: 8x8 IN. | WEIGHT OR SDR #: 0.188" | DIAMETER AND DEPTH OF DRILL HOLE: 8¼ IN. 22.3 FT.
JOINTS: ☐ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER
MATERIAL: ☐ THERMO PLASTIC ☒ STEEL ☐ FLUORO POLYMER TYPE
LOCKING CAP? ☒ YES ☐ NO

CAP VENTED: ☒ YES ☐ NO
WEEP HOLE? ☒ YES ☐ NO
CASING GROUT DETAILS: MATERIAL: ☐ CEMENT ☒ CONCRETE ☐ OTHER
DEPTH FROM THE SURFACE TO THE BOTTOM OF THE CASING GROUT SEAL: 3.0 FT.
TYPE OF SURFACE COMPLETION: ☒ ABOVE GROUND ☐ FLUSH MOUNT
DESCRIBE HOW THE FLUSH MOUNT WAS CONSTRUCTED

CENTRALIZER USED ON RISER: ☒ NO ☐ YES LOCATED AT
MATERIAL: ☐ STAINLESS STEEL ☐ OTHER

RISER PIPE DETAILS:
LENGTH: 14.2 FT. | DIAMETER OF RISER PIPE: 2 IN. | WEIGHT OR SDR #: SCH 80 | DIAMETER OF DRILL HOLE: 8¼ IN.
JOINTS: ☒ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER
MATERIAL: ☒ THERMO PLASTIC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER

ANNULAR SEAL: ☐ CEMENT SLURRY ☒ BENTONITE SLURRY ☐ NON SLURRY BENTONITE ☐ CEMENT/BENTONITE SLURRY
TYPE: BAGS OF CEMENT USED % BENTONITE USED WATER USED/BAG GAL
BENTONITE SEAL: MATERIAL: BENTONITE ☒ SLURRY ☐ CHIPS ☐ GRANULAR ☐ PELLETS
LENGTH OF SEAL: 6.0
BENTONITE SEAL INSTALLED IN: ☐ UNSATURATED ZONE ☒ SATURATED ZONE

	TYPE	GRAIN SIZE	LENGTH OF FILTER PACK	METHOD OF INSTALLATION	Information in this column to be supplied in the Feet from Surface column	FEET FROM SURFACE	FORMATION DESCRIPTION
PRIMARY FILTER PACK	☒ SAND ☐ MANUFACTURED ☐ NATURAL	16-35	12.4 FT.	H.S.A. POUR			
SECONDARY FILTER PACK	☒ SAND ☐ MANUFACTURED ☐ NONE	100	0.9 FT.	H.S.A. POUR	Depth to bottom of Protective Casing Seal:	3.0	0-15 Silty clay
WELL SCREEN	LENGTH OF SCREEN: 10 FT.	DIAMETER: 2 IN.	SLOT SIZE: 10	WEIGHT OR SDR #: SCH 80	MATERIAL: ☒ PLASTIC ☐ STEEL ☐ FLUORO POLYMER	Depth to Base of Annular Seal:	9.0	
SUMP DETAILS	LENGTH OF SUMP	DIAMETER OF SUMP	MATERIAL: ☐ PVC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER			Depth to Base of Bentonite Seal:	9.0	
BACK FILL	WAS THE WELL BACK FILLED? ☐ YES ☒ NO	MATERIAL USED	LENGTH OF BACK FILLED BORE HOLE			Depth to Top of Primary Filter Pack:	9.9	
						Depth to Top of the Screen:	12.3	
						Depth to Bottom of the Screen:	22.3	15-22.3 Silty sand
						Total Depth:	22.3	

STATIC WATER LEVEL FEET FROM MEASURING POINT
DATE OF STATIC WATER LEVEL
MEASURING POINT FOR STATIC WATER LEVEL IS: ☒ TOP OF RISER PIPE ☐ OTHER
ELEVATION OF MEASURING POINT: 451.42
MULTIPLE CASED WELLS: SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.
DRILLING EQUIPMENT: ☐ AIR ROTARY ☒ AUGER TYPE 4¼ H.S.A. ☐ REVERSE ROTARY ☐ OTHER
DATE WELL DRILLING WAS COMPLETED: 9-25-95

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE PRIMARY CONTRACTOR/PERMIT #	DATE	SIGNATURE DRILLER/PERMIT #	DATE
Loman D. Mahurin M.	11-15-95	Loman D. Mahurin M.	11-15-95

MO 780-1415 (7-95)

DISTRIBUTION: WHITE/DIVISION CANARY/MONITORING WELL CONTRACTOR PINK/OWNER
MAIL WHITE COPY TO: DEPARTMENT OF NATURAL RESOURCES, P.O. BOX 250, ROLLA, MO 65402
ENCLOSE $35 PER MONITORING WELL FOR THE CERTIFICATION FEE WITHIN 60 DAYS AFTER WELL COMPLETION

RECYCLED PAPER

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger		BORING NO. PZ-303-AS
			SHEET 1 OF 2
LAIDLAW/OU2 RI-FS/MD WEST LAKE LANDFILL OPERABLE UNIT 2	SAMPLING METHOD: SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP) SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)		DRILLING START / FINISH
	WATER LEVEL / TIME / DATE / CASING DEPTH		TIME 16:45 / TIME 8:45
			DATE 10/4/95 / DATE 10/5/95
DATUM NORTHING: 1067763.32 EASTING: 514425.53	ELEVATION 450.8		
DRILL RIG CME 750	SURFACE CONDITIONS		
ANGLE 90° BEARING NA			
SAMPLE HAMMER			

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
1	3, 5, 7, 9	1.9'/2.0' (95%)			(0.0-3.1 ft.) Compact, moderate yellowish brown (10YR 5/4), SILT, NR, dry, (ML), (FILL)	SP ①	
2					(3.1-4.6 ft.) Compact, olive gray (5Y 4/1), SANDY SILT, NR, dry, (ML), (LOESS)		
3	7, 7, 6, 8	1.8'/2.0' (90%)				SP ②	
4	2, 3, 5, 5	1.8'/2.0' (90%)			(446.2) 4.6	SP ③	0.0 ppm PID
5					(4.6-7.4 ft.) Loose, olive gray (5Y 4/1), Fine SAND, trace Silt, NR, damp, (SP), (ALLUVIUM)		
6	1, 3, 2, 3	1.9'/2.0' (95%)				SP ④	
7					(7.4-12.2 ft.) Loose, olive black, fine SAND, NR, moist, (SP), (ALLUVIUM)		
8	1, 1, 6, 6	1.7'/2.0' (85%)				SP ⑤	Faint petroleum odor @ 7.4 ft.
9							
10	2, 2, 2, 2	1.2'/2.0' (60%)				SP ⑥	0.1 ppm PID
11							
12	3, 6, 7, 8	1.8'/2.0' (90%)			(12.2-26.0 ft.) Compact to dense, medium dark gray (N4), f-m SAND, NR, damp, (SP), (ALLUVIUM)	SP ⑦	Strong petroleum odor
13							
14	6, 5, 9, 10	1.8'/2.0' (90%)				SP ⑧	0.9 ppm PID

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: PZ303AS

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION: LAIDLAW/OU2 RI-FS/MD, WEST LAKE LANDFILL, OPERABLE UNIT 2	DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger		BORING NO. PZ-303-AS
			SHEET 2 OF 2
	SAMPLING METHOD:		DRILLING START / FINISH
	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)		
	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)		
	WATER LEVEL		TIME: 16:45 / 8:45
	TIME		
	DATE		DATE: 10/4/95 / 10/5/95
DATUM: NORTHING: 1067763.32, EASTING: 514425.53	CASING DEPTH	ELEVATION: 450.8	

DRILL RIG: CME 750 — SURFACE CONDITIONS:

ANGLE: 90° — BEARING: NA

SAMPLE HAMMER:

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
16	5 3 4 12	1.8" / 2.0" (90%)			(12.2-26.0 Ft.) Compact to dense, medium dark gray (N4), F-m SAND, NR, damp to wet, (SP), (ALLUVIUM)	SP (8)	
					from 15.3-15.6 ft, seam of olive black sandy SILT		
17					@ 17.0 ft, wet	SP (9)	
18	6 17 28 49	1.8" / 2.0" (90%)			From 17.5-17.8 ft, seam of olive black SILT	SP (10)	
19							
20	11 19 13 10	2.0" / 2.0" (100%)				SP (11)	6.6 ppm PID
21							
22	3 5 10 11	1.9" / 2.0" (95%)				SP (12)	Petroleum sheen in Split Spoon
23							
24	3 16 26 39	2.0" / 2.0" (100%)				SP (13)	3.7 ppm PID
25					(424.8) 26.0		
26					End of Soil Borehole Log at 26.0 ft.		
27							
28							
29							

DRILLING CONTR: LAYNE-WESTERN

LOGGED BY: B. HARRINGTON — CHK'D BY: B. TILTON

DATE: 10/9/95

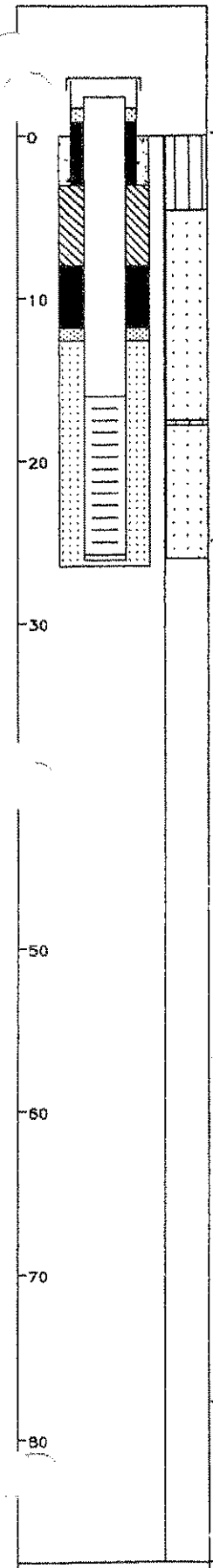
JOB NO.: 943-2848

FILENAME: PZ303AS

Well No. PZ-303-AS

Boring No. X-Ref: PZ-303-AS

PIEZOMETER CONSTRUCTION SUMMARY



Not to Scale

Survey Coords: Northing: 1067763 ft. Easting: 514426 ft.

Elevation Ground Level 450.8 ft. NGVD

Top of PVC Casing 453.18 ft. NGVD

Drilling Summary:

Total Depth 26.5 ft.

Borehole Diameter 8 1/4" (0.0-26.5')

Casing Stickup Height 2.38 ft.

Driller Layne-Western, St. Louis, MO

Rig CME 750

Bit(s) 4 1/4" ID Hollow Stem Auger Bit

Drilling Fluid None

Protective Casing 8x8" Square Steel, by 5' long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
CME 750	10/4/95	16:45	10/5/95	8:45
Geophys.Logging:				
Casing:				
2" I.D. PVC	10/5/95	9:00	10/5/95	9:05
Filter Placement:	10/5/95	9:05	10/5/95	9:55
Cementing:				
Development				
Bentonite Grout	10/5/95	10:15	10/5/95	10:20
Bentonite Seal	10/6/95	9:55	10/6/95	10:05

Well Design & Specifications

Basis: Geologic Log X Geophysical Log

Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 2.38	-	16.00	C1	453.18	-	434.80
16.00	-	25.80	S1	434.80	-	425.00
25.80	-	26.10	C2	425.00	-	424.70

Casing: C1 2" dia. Schedule 80 PVC, flush threaded with O-rings

C2 2" dia. threaded PVC end cap (4" long or 0.33')

Screen: S1 2" dia. Schedule 80 PVC, 0.010" machine cut slot, flush threaded with O-rings

Sand Pack: 16-35 mesh Silica Sand 12.6-26.5'

Filter Pack: Less than 50 mesh Silica Sand 11.8-12.6'

Grout Seal: Wyo-Ben Grout Well Bentonite Slurry 3.0-8.0'

Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry 8.0-11.8'

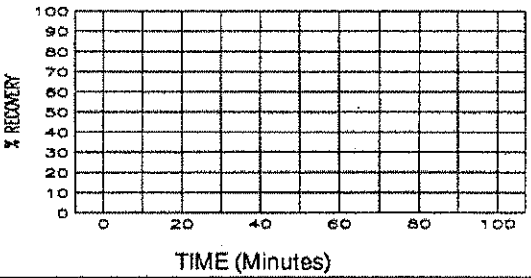
Concrete: 0.0-3.0'

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments:

Supervised by B. Harrington

Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO

File Name PZ303AS

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF. NO. 145101	
C.R. NO.	CHECK NO.
STATE WELL NUMBER	TRANSMITTAL NO.
CHECKED BY	ROUTE
APPROVED BY	ENTERED Ph 1 Ph 2 Ph 3

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

SITE/FACILITY NAME: LAIDLAW @ BRIDGETON SANITARY LANDFILL
WELL NUMBER: PZ-303AS

SITE ADDRESS: ST. CHARLES ROCK RD
CITY: BRIDGETON
STATE: Mo
ZIP CODE: 63044

OWNER NAME: LAIDLAW WASTE SYSTEMS, INC.
TELEPHONE: 314-241-3710

OWNER ADDRESS: 1839 N. BROADWAY
CITY: ST. LOUIS
STATE: Mo
ZIP CODE: 63102

VARIANCE ISSUED: ☐ YES ☒ NO
DATE ISSUED:
VARIANCE NUMBER: V

DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT
AT FENCE LINE, 360' NORTH OF SOUTHWEST FENCE CORNER

LOCATION OF WELL
SHOW LOCATION IN SECTION PLAT
COUNTY
SURFACE ELEVATION: 450.8
SMALLEST ¼ ____ ¼ ____ ¼ ____ ¼ LARGEST ¼
SEC. ____ TWN. 47 N.RNG. 5 E OR W
LAT. 38 ° 45 ' 58 " LONG. 90 ° 26 ' 58 "

MONITORING WELL INSTALLATION CONTRACTOR'S NAME: LAYNE WESTERN CO, INC.
PERMIT NUMBER: 001258 WPM

DRILLING CONTRACTOR'S NAME: LAYNE WESTERN CO., INC.
PERMIT NUMBER: 001258 WPM

WELL CONSTRUCTION INFORMATION

TYPE OF WELL: ☐ MONITORING WELL ☒ PIEZOMETER ☐ OTHER
TYPE OF POTENTIAL SITE: ☐ HAZARDOUS MATERIAL ☒ LANDFILL ☐ OTHER ☐ L.U.S.T.
MONITORING FOR: (CHECK ALL THAT APPLY) ☒ V.O.C. ☐ METALS ☐ PETROLEUM PRODUCT ☐ OTHER ONLY

PROTECTIVE CASING DETAILS (IF USED):
- LENGTH: 5.0 FT.
- DIAMETER OF CASING: 8x8 IN.
- WEIGHT OR SDR #: 0.188"
- DIAMETER AND DEPTH OF DRILL HOLE: 8¼ IN. 26.5 FT.
- JOINTS: ☐ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER
- MATERIAL: ☒ STEEL ☐ THERMO PLASTIC ☐ FLUORO POLYMER TYPE
- LOCKING CAP? ☒ YES ☐ NO

CAP VENTED: ☒ YES ☐ NO
WEEP HOLE? ☒ YES ☐ NO

CASING GROUT DETAILS:
- MATERIAL: ☐ CEMENT ☒ CONCRETE ☐ OTHER
- DEPTH FROM THE SURFACE TO THE BOTTOM OF THE CASING GROUT SEAL: 5.0 FT.

TYPE OF SURFACE COMPLETION: ☒ ABOVE GROUND ☐ FLUSH MOUNT
DESCRIBE HOW THE FLUSH MOUNT WAS CONSTRUCTED

CENTRALIZER USED ON RISER: ☒ NO ☐ YES LOCATED AT
MATERIAL: ☐ STAINLESS STEEL ☐ OTHER

RISER PIPE DETAILS:
- LENGTH: 18.9 FT.
- DIAMETER OF RISER PIPE: 2 IN.
- WEIGHT OR SDR #: SCH80
- DIAMETER OF DRILL HOLE: 8¼ IN.
- JOINTS: ☒ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER
- MATERIAL: ☒ THERMO PLASTIC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER

ANNULAR SEAL: ☐ CEMENT SLURRY ☒ BENTONITE SLURRY ☐ NON SLURRY BENTONITE ☐ CEMENT/BENTONITE SLURRY
TYPE:
BAGS OF CEMENT USED
% BENTONITE USED
WATER USED/BAG GAL.

BENTONITE SEAL:
- MATERIAL: BENTONITE ☒ SLURRY ☐ CHIPS ☐ GRANULAR ☐ PELLETS
- LENGTH OF SEAL: 3.8
- BENTONITE SEAL INSTALLED IN: ☐ UNSATURATED ZONE ☒ SATURATED ZONE

PRIMARY FILTER PACK:
- TYPE: ☒ SAND ☐ MANUFACTURED ☐ NATURAL
- GRAIN SIZE: 16-35
- LENGTH OF FILTER PACK: 13.9 FT.
- METHOD OF INSTALLATION: H.S.A. POUR

SECONDARY FILTER PACK:
- TYPE: ☒ SAND ☐ MANUFACTURED ☐ NONE
- GRAIN SIZE: < 50
- LENGTH OF FILTER PACK: 0.8 FT.
- METHOD OF INSTALLATION: H.S.A. POUR

WELL SCREEN:
- LENGTH OF SCREEN: 10 FT.
- DIAMETER: 2 IN.
- SLOT SIZE: 10
- WEIGHT OR SDR #: SCH 80
- MATERIAL: ☒ PLASTIC ☐ STEEL ☐ FLUORO POLYMER

SUMP DETAILS:
- LENGTH OF SUMP
- DIAMETER OF SUMP
- MATERIAL: ☐ PVC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER

BACK FILL:
- WAS THE WELL BACK FILLED? ☐ YES ☒ NO
- MATERIAL USED
- LENGTH OF BACK FILLED BORE HOLE

Information in this column to be supplied in the Feet from Surface column

Depth to bottom of Protective Casing Seal:	3.0
Depth to Base of Annular Seal:	8.0
Depth to Base of Bentonite Seal:	11.8
Depth to Top of Primary Filter Pack:	12.6
Depth to Top of the Screen:	16.5
Depth to Bottom of the Screen:	26.5
Total Depth:	26.5

FEET FROM SURFACE / FORMATION DESCRIPTION

FEET FROM SURFACE	FORMATION DESCRIPTION
0-4.5	Silty clay
4.5-26.5	Silty sand

STATIC WATER LEVEL FEET FROM MEASURING POINT
DATE OF STATIC WATER LEVEL
MEASURING POINT FOR STATIC WATER LEVEL IS: ☒ TOP OF RISER PIPE ☐ OTHER
ELEVATION OF MEASURING POINT: 453.18

MULTIPLE CASED WELLS
SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.

DRILLING EQUIPMENT: ☐ AIR ROTARY ☒ AUGER TYPE 4¼ H.S.A. ☐ REVERSE ROTARY ☐ OTHER

DATE WELL DRILLING WAS COMPLETED: 10-05-95

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE PRIMARY CONTRACTOR/PERMIT #	DATE	SIGNATURE DRILLER/PERMIT #	DATE
Tomas J. Mahurin M.	11-15-95	Tomas J. Mahurin M.	11-15-95

MO 780-1415 (7-95)

DISTRIBUTION: WHITE/DIVISION CANARY/MONITORING WELL CONTRACTOR PINK/OWNER
MAIL WHITE COPY TO: DEPARTMENT OF NATURAL RESOURCES, P.O. BOX 250, ROLLA, MO 65402
ENCLOSE $35 PER MONITORING WELL FOR THE CERTIFICATION FEE WITHIN 60 DAYS AFTER WELL COMPLETION

RECYCLED PAPER

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	LAIDLAW/OU2 RI-FS/MO WEST LAKE LANDFILL OPERABLE UNIT 2
DRILLING METHOD:	4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger 3.625 inch Mud Rotary
SAMPLING METHOD:	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP) SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)
BORING NO.	PZ-304-AI
SHEET	1 OF 3
DRILLING	START / FINISH
WATER LEVEL	18.5 FT.
TIME	16:00
DATE	10/2/95
CASING DEPTH	40.0 FT.
TIME	8:00 / 14:15
DATE	10/2/95 / 10/2/95
DATUM	NORTHING: 1068125.91 EASTING: 514434.70
ELEVATION	451.6
DRILL RIG	CME 750
ANGLE	90°
BEARING	NA
SAMPLE HAMMER	
SURFACE CONDITIONS	

DRILLING CONTR: LAYNE-WESTERN

LOGGED BY: B. HARRINGTON

DATE: 10/9/95

CHK'D BY: B. TILTON

JOB NO.: 943-2848

FILENAME: PZ304AI

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE		REMARKS
16					(0.0-28.0 Ft.) No samples collected, see Soil Borehole Log PZ-304-AS for descriptions			
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28 (423.6)	12 15 14 12	1.6' 2.0' (80%)			(28.0-39.3 Ft.) Compact, light olive gray (5Y 5/2), well graded, SAND, NR, wet, (SW), (ALLUVIUM)	SP ①		0.0 ppm PID
29								

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MO
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068125.91
DATUM EASTING: 514434.70 ELEVATION 451.6

DRILLING METHOD:
4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger
3.625 inch Mud Rotary

SAMPLING METHOD:
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

WATER LEVEL	18.5 FT.				
TIME	16:00				
DATE	10/2/95				
CASING DEPTH	40.0 FT.				

BORING NO. PZ-304-AI

SHEET 2 OF 3

DRILLING

START	FINISH
TIME 8:00	TIME 14:15
DATE 10/2/95	DATE 10/2/95

DRILL RIG CME 750

ANGLE 90° BEARING NA

SAMPLE HAMMER

SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
31	8 11 12 13	1.6'/2.0' (80%)			(28.0-39.3 ft.) Compact, light olive gray (5Y 5/2), well graded, SAND, NR, wet, (SW), (ALLUVIUM)	SP 2	
32	8 15 15 12	1.1'/2.0' (55%)				SP 3	
33							
34	5 8 4 3	1.2'/2.0' (60%)				SP 4	0.0 ppm PID
35							
36	1.1 6 6 7 8	2.0'/2.0' (100%)			from 35.6-35.8 ft, Lignite coal partical	SP 5	
37							
38	9 9 17 16	1.3'/2.0' (65%)			(412.3) 39.3	SP 6	
39					(39.3-46.0 ft.) Compact to dense, olive gray (5Y 4/1), f-m SAND, NR, wet, (SP), (ALLUVIUM)		
40	10 18 28 27	1.8'/2.0' (90%)				SP 7	0.0 ppm PID
41							
42	7 11 12 14	1.4'/2.0' (70%)			from 43.0-43.5 ft, seam of compact, olive gray (5Y 4/1), well graded SAND	SP 8	
43							
44	15 17 10 14	0.7'/2.0' (35%)				SP 9	

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON CHK'D BY B. TILTON

DATE 10/9/95

JOB NO.: 943-2848

FILENAME: PZ304AI

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD:					BORING NO.
	4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger					PZ-304-AJ
	3.625 inch Mud Rotary					SHEET 3 OF 3
	SAMPLING METHOD:					DRILLING
	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)					START / FINISH
	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)					
LAIDLAW/OU2 RI-FS/MD WEST LAKE LANDFILL OPERABLE UNIT 2	WATER LEVEL	18.5 FT.				TIME: 8:00 / 14:15
	TIME	16:00				
	DATE	10/2/95				DATE: 10/2/95 / 10/2/95
NORTHING: 1068125.91 DATUM EASTING: 514434.70 ELEVATION 451.6	CASING DEPTH	40.0 FT.				

DRILL RIG CME 750 — SURFACE CONDITIONS

ANGLE 90° BEARING NA

SAMPLE HAMMER

DEPTH IN FEET (ELEVATION)	BLOW/6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
46					(39.3-46.0 Ft.) Compact to dense, olive gray (5Y 4/1), f-m SAND, NR, wet, (SP), (ALLUVIUM) (405.6) 46.0	SP (9)	0.0 ppm PID
47	3 3 6 6	1.2'/2.0' (60%)			(46.0-48.4 Ft.) Loose, olive gray (5Y 4/1), well graded SAND, some fine Gravel, NR, wet, (SW), (ALLUVIUM)	SP (10)	
48					(403.2) 48.4		
49	9 12 17 15	1.3'/2.0' (65%)			(48.4-50.0 Ft.) Compact, olive gray (5Y 4/1), f-m SAND, trace coarse Sand and fine Gravel, NR, wet, (SP), (ALLUVIUM)	SP (11)	
50					(401.6) 50.0		0.0 ppm PID
					End of Soil Borehole Log at 50.0 ft.		
51							
52							
53							
54							
55							
56							
57							
58							
59							

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON CHK'D BY B. TILTON

DATE 10/9/95

JOB NO.: 943-2848

FILENAME: PZ304AJ

Well No. PZ-304-AI

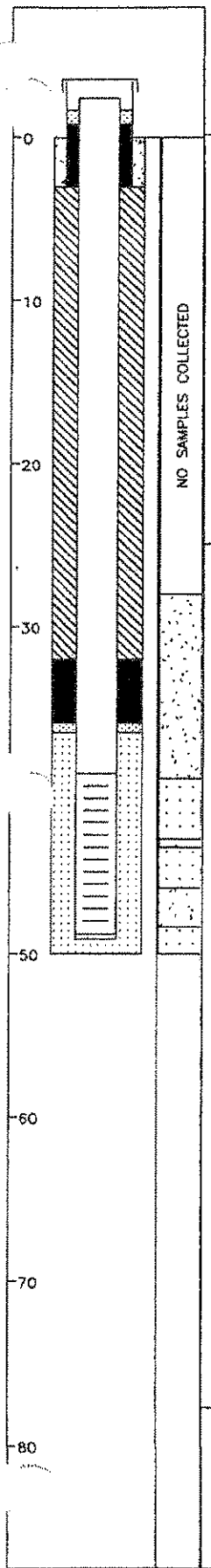
Boring No. X-Ref: PZ-304-AI

PIEZOMETER CONSTRUCTION SUMMARY

Survey Coords: Northing: 1068126 ft. Easting: 514435 ft.

Elevation Ground Level 451.6 ft. NGVD

Top of PVC Casing 454.02 ft. NGVD



Drilling Summary:

Total Depth 50.0 ft.

Borehole Diameter 8 1/4" (0.0-50.0')

Casing Stickup Height 2.42 ft.

Driller Layne-Western St. Louis, MO

Rig CME 75, Schramm Portadrill T660H

Bit(s) 4 1/4" ID Hollow Stem Auger Bit; 3/8" Tricone Bit

Drilling Fluid Bentonite Drilling Mud (23.0-50.0')

Protective Casing 8x8" Square Steel, by 5' long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
CME 750	10/2/95	8:00	10/2/95	14:15
Geophys. Logging:				
Casing:				
2" I.D. PVC	10/2/95	14:20	10/2/95	14:25
Filter Placement:	10/2/95	14:25	10/2/95	15:10
Cementing:				
Development				
Bentonite Grout	10/2/95	15:45	10/2/95	16:45
Bentonite Seal	10/2/95	15:15	10/2/95	15:20

Well Design & Specifications

Basis: Geologic Log X Geophysical Log

Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 2.42	-	39.00	C1	454.02	-	412.60
39.00	-	48.80	S1	412.60	-	402.80
48.80	-	49.10	C2	402.80	-	402.50

Casing: C1 2" dia. Schedule 80 PVC, flush threaded with O-rings

C2 2" dia. threaded PVC end cap (4" long or 0.33')

Screen: S1 2" dia. Schedule 80 PVC, 0.010" machine cut slot, flush threaded with O-rings

Sand Pack: 16-35 mesh Silica Sand 36.5-50.0'

Filter Pack: 100 mesh Silica Sand 35.9-36.5'

Grout Seal: Wyo-Ben Grout Well Bentonite Slurry 3.0-32.0'

Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry 32.0-35.9'

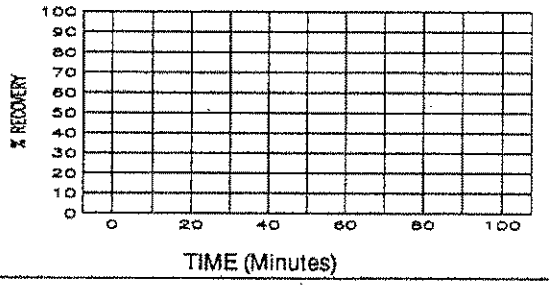
Concrete: 0.0-3.0'

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments:

Not to Scale

Supervised by B. Harrington

Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO

File Name PZ304AI

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF. NO. 145103	
C.R. NO.	CHECK NO.
STATE WELL NUMBER	TRANSMITTAL NO.
CHECKED BY	ROUTE
APPROVED BY	ENTERED Ph 1 Ph 2 Ph 3

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

SITE/FACILITY NAME: LAIDLAW BRIDGETON SANITARY LANDFILL
WELL NUMBER: PZ-304AI
SITE ADDRESS: ST. CHARLES ROCK RD
CITY: BRIDGETON
STATE: Mo
ZIP CODE: 63044
OWNER NAME: LAIDLAW WASTE SYSTEMS, INC.
TELEPHONE: 314-241-3710
OWNER ADDRESS: 1538 N. BROADWAY
CITY: ST. LOUIS
STATE: Mo
ZIP CODE: 63102

VARIANCE ISSUED: ☐ YES ☒ NO
DATE ISSUED:
VARIANCE NUMBER: V

DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT
AT WEST FENCE LINE, 720' NORTH OF SOUTHWEST FENCE CORNER.

LOCATION OF WELL
SHOW LOCATION IN SECTION PLAT
COUNTY: ST. LOUIS
SURFACE ELEVATION: 451.6
SMALLEST ¼ ____ ¼ ____ ¼ LARGEST ¼ ____ ¼
SEC. ____ TWN. 47 N,RNG. 5 (E OR W)
LAT. 38° 46' 01" LONG. 90° 26' 58"

MONITORING WELL INSTALLATION CONTRACTOR'S NAME: LAYNE WESTERN CO., INC. PERMIT NUMBER: 001258 WPM
DRILLING CONTRACTOR'S NAME: LAYNE WESTERN CO., INC. PERMIT NUMBER: 001258 WPM

WELL CONSTRUCTION INFORMATION

TYPE OF WELL: ☐ MONITORING WELL ☒ PIEZOMETER ☐ OTHER
TYPE OF POTENTIAL SITE: ☐ HAZARDOUS MATERIAL ☒ LANDFILL ☐ L.U.S.T. ☐ OTHER
MONITORING FOR: (CHECK ALL THAT APPLY) ☒ V.O.C. ☐ METALS ☐ PETROLEUM PRODUCT ☐ OTHER ONLY

PROTECTIVE CASING DETAILS (IF USED): LENGTH 5 FT. | DIAMETER OF CASING 8x8 IN. | WEIGHT OR SDR # 0.188" | DIAMETER AND DEPTH OF DRILL HOLE 8¼ IN. 50 FT. | JOINTS ☐ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER | MATERIAL ☐ THERMO PLASTIC ☒ STEEL ☐ FLUORO POLYMER TYPE | LOCKING CAP? ☒ YES ☐ NO

CAP VENTED ☒ YES ☐ NO
WEEP HOLE? ☒ YES ☐ NO
CASING GROUT DETAILS: MATERIAL ☐ CEMENT ☒ CONCRETE ☐ OTHER
DEPTH FROM THE SURFACE TO THE BOTTOM OF THE CASING GROUT SEAL: 3.0 FT.
TYPE OF SURFACE COMPLETION: ☒ ABOVE GROUND ☐ FLUSH MOUNT
DESCRIBE HOW THE FLUSH MOUNT WAS CONSTRUCTED

CENTRALIZER USED ON RISER: ☒ NO ☐ YES LOCATED AT
MATERIAL: ☐ STAINLESS STEEL ☐ OTHER

RISER PIPE DETAILS: LENGTH 42.4 FT. | DIAMETER OF RISER PIPE 2 IN. | WEIGHT OR SDR # SCH 80 | DIAMETER OF DRILL HOLE 8¼ IN. | JOINTS ☒ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER | MATERIAL ☒ THERMO PLASTIC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER

ANNULAR SEAL: ☐ CEMENT SLURRY ☒ BENTONITE SLURRY ☐ NON SLURRY BENTONITE ☐ CEMENT/BENTONITE SLURRY
TYPE: BAGS OF CEMENT USED % BENTONITE USED WATER USED/BAG GAL.
BENTONITE SEAL: MATERIAL BENTONITE ☒ SLURRY ☐ CHIPS ☐ GRANULAR ☐ PELLETS | LENGTH OF SEAL 3.9 | BENTONITE SEAL INSTALLED IN ☐ UNSATURATED ZONE ☒ SATURATED ZONE

	TYPE	GRAIN SIZE	LENGTH OF FILTER PACK	METHOD OF INSTALLATION
PRIMARY FILTER PACK	☒ SAND ☐ MANUFACTURED ☐ NATURAL	16-35	13.5 FT.	H.S.A. POUR
SECONDARY FILTER PACK	☒ SAND ☐ MANUFACTURED ☐ NONE	100	0.6 FT.	H.S.A. POUR

WELL SCREEN: LENGTH OF SCREEN 10 FT. | DIAMETER 2 IN. | SLOT SIZE 10 | WEIGHT OR SDR # SCH80 | MATERIAL ☒ PLASTIC ☐ STEEL ☐ FLUORO POLYMER

SUMP DETAILS: LENGTH OF SUMP | DIAMETER OF SUMP | MATERIAL ☐ PVC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER

BACK FILL: WAS THE WELL BACK FILLED? ☐ YES ☒ NO | MATERIAL USED | LENGTH OF BACK FILLED BORE HOLE

Information in this column to be supplied in the Feet from Surface column	FEET FROM SURFACE	FORMATION DESCRIPTION
Depth to bottom of Protective Casing Seal:	3.0	0-15 Gray silty clay
Depth to Base of Annular Seal:	32.0	15-18 Silty sand 18-28 Sand & gravel
Depth to Base of Bentonite Seal:	35.9	28-50 Sand
Depth to Top of Primary Filter Pack:	36.5	
Depth to Top of the Screen:	40.0	
Depth to Bottom of the Screen:	50.0	
Total Depth:	500	
DATE WELL DRILLING WAS COMPLETED	10-02-95	

STATIC WATER LEVEL FEET FROM MEASURING POINT
DATE OF STATIC WATER LEVEL
MEASURING POINT FOR STATIC WATER LEVEL IS ☒ TOP OF RISER PIPE ☐ OTHER
ELEVATION OF MEASURING POINT 454.02
MULTIPLE CASED WELLS: SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.
DRILLING EQUIPMENT: ☐ AIR ROTARY ☒ AUGER TYPE 4¼ H.S.A. ☐ REVERSE ROTARY ☐ OTHER

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE PRIMARY CONTRACTOR/PERMIT #: Lorman D. Mahurin Jr. | DATE: 11-15-95
SIGNATURE DRILLER/PERMIT #: Lorman D. Mahurin Jr. | DATE: 11-15-95

MO 780-1415 (7-95)
DISTRIBUTION: WHITE/DIVISION CANARY/MONITORING WELL CONTRACTOR PINK/OWNER
MAIL WHITE COPY TO: DEPARTMENT OF NATURAL RESOURCES, P.O. BOX 250, ROLLA, MO 65402
ENCLOSE $35 PER MONITORING WELL FOR THE CERTIFICATION FEE WITHIN 60 DAYS AFTER WELL COMPLETION
RECYCLED PAPER

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION	DRILLING METHOD:		BORING NO.
	4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger		PZ-304-AS
			SHEET 1 OF 2
	SAMPLING METHOD:		
	SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)		DRILLING
LAIDLAW/OU2 RI-FS/MO WEST LAKE LANDFILL OPERABLE UNIT 2	SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)		START / FINISH
	WATER LEVEL		TIME 10:10 / TIME 12:10
	TIME		
	DATE		DATE 9/27/95 / DATE 9/27/95
	CASING DEPTH		

NORTHING: 1068146.47
DATUM EASTING: 514434.57 ELEVATION 451.4

DRILL RIG CME 750 — SURFACE CONDITIONS

ANGLE 90° BEARING NA

SAMPLE HAMMER

DEPTH IN FEET (ELEVATION)	BLOW/6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
1	4 4 4 7	1.8'/2.0' (90%)			(0.0-3.7 Ft.) Loose, moderate yellowish brown (10YR 5/4), SILT, NR, dry, (ML), (FILL)	SP (1)	
					@ 0.6 Ft., damp		
2	6 8 7 8	1.5'/2.0' (75%)			(3.7-6.8 Ft.) Compact, olive gray (5Y 4/1), SILT, NR, damp, (ML), (LOESS)	SP (2)	
					@ 6.0 Ft., trace organic material		
3							
4	3 4 5 6	1.7'/2.0' (85%)				SP (3)	
5							
6	2 3 4 4	1.6'/2.0' (80%)				SP (4)	0.0 ppm PID
7					(6.8-10.4 Ft.) Loose, olive gray (5Y 4/1), Fine SANDY SILT, NR, damp, (ML), (LOESS)		
8	2 1 2 2	1.2'/2.0' (60%)				SP (5)	
9							
10	1 3 5 5	1.7'/2.0' (85%)			@ 8.4 Ft., moist	SP (6)	
11					(10.4-13.0 Ft.) Loose, olive gray (5Y 4/1), SILT, NR, damp, (ML), (LOESS)		
12	1 2 4 11	1.6'/2.0' (80%)				SP (7)	0.0 ppm PID
13					(438.4) 13.0 (13.0-14.2 Ft.) Loose, olive gray (5Y 4/1), SILTY Fine SAND, NR, moist, (SM), (ALLUVIUM)		
14	5 7 10 20	1.7'/2.0' (85%)			(437.2) 14.2 (14.2-27.1 Ft.) Compact to dense, light olive gray (5Y 6/1), Fine SAND, NR, damp, (SP), (ALLUVIUM)	SP (8)	

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON

DATE 10/9/95 CHK'D BY B. TILTON

JOB NO.: 943-2848

FILENAME: PZ304AS

LAIDLAW WASTE SYSTEMS INC.

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

LAIDLAW/OU2 RI-FS/MD
WEST LAKE LANDFILL
OPERABLE UNIT 2

NORTHING: 1068146.47
DATUM EASTING: 514434.57 ELEVATION 451.4

DRILLING METHOD: 4.25 inch I.D./8.25 inch O.D. Hollow Stem Auger

SAMPLING METHOD:
SPLIT SPOON: 2.0 inch O.D./1.5 inch I.D. (SP)
SHELBY TUBE: 3.0 inch O.D./2 13/16 inch I.D. (SH)

WATER LEVEL				
TIME				
DATE				
CASING DEPTH				

BORING NO. PZ-304-AS

SHEET 2 OF 2

DRILLING START		DRILLING FINISH	
TIME	DATE	TIME	DATE
10:10	9/27/95	12:10	9/27/95

DRILL RIG CME 750
ANGLE 90° BEARING NA
SAMPLE HAMMER
SURFACE CONDITIONS

DEPTH IN FEET (ELEVATION)	BLOW/ 6 IN. ON SAMPLER	RECOVERY	SYMBOL	SAMPLER SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER TYPE	REMARKS
16	9 15 17 11	1.4' 2.0' (70%)			(14.2-27.1 ft.) Compact to dense, light olive gray (5Y 6/1), fine SAND, NR, damp, (SP), (ALLUVIUM)	SP 8	
17						SP 9	
18	5 6 14 24	1.8' 2.0' (90%)			@ 17.7 ft., moist @ 18.0 ft., wet	SP 10	0.0 ppm PID Slight organic odor
19							
20	2 15 18 14	1.7' 2.0' (85%)				SP 11	
21							
22	3 5 8 14	0.7' 2.0' (35%)				SP 12	0.1 ppm PID
23							
24	3 5 14 15	1.6' 2.0' (80%)				SP 13	
25							
26	5 11 12 13	1.2' 2.0' (60%)				SP 14	0.0 ppm PID
27					(27.1-28.0 ft.) Compact, olive gray (5Y 4/1), f-m SAND, NR, wet, (SP), (ALLUVIUM)		
28					(423.4) 28.0 End of Soil Borehole Log at 28.0 ft.		
29							

DRILLING CONTR LAYNE-WESTERN

LOGGED BY B. HARRINGTON CHK'D BY B. TILTON

DATE 10/9/95

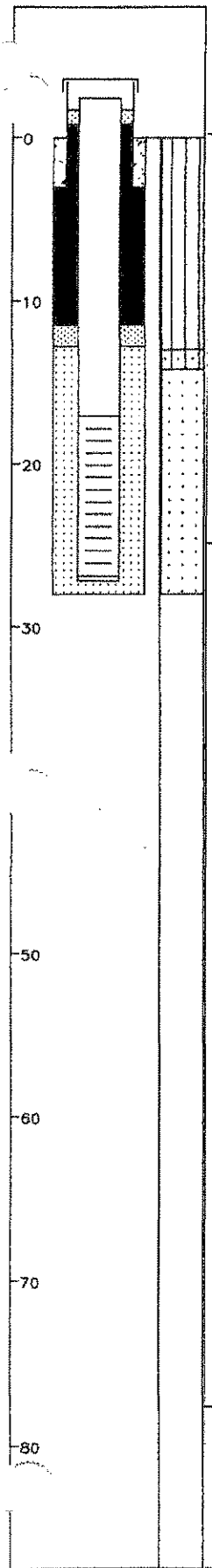
JOB NO.: 943-2848

FILENAME: PZ304AS

Well No. PZ-304-AS

Boring No. X-Ref: PZ-304-AS

PIEZOMETER CONSTRUCTION SUMMARY



Not to Scale

Survey Coords: Northing: 1068146 ft. Easting: 514435 ft.

Elevation Ground Level 451.4 ft. NGVD

Top of PVC Casing 453.71 ft. NGVD

Drilling Summary:

Total Depth 28.0 ft.

Borehole Diameter 8 1/4" (0.0-28.0')

Casing Stickup Height 2.31 ft.

Driller Layne-Western St. Louis, MO

Rig CME 750

Bit(s) 4 1/4" ID Hollow Stem Auger Bit

Drilling Fluid None

Protective Casing 8x8" Square Steel, by 5' long

Construction Time log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
CME 750	9/27/95	10:10	9/27/95	12:10
Geophys.Logging:				
Casing:				
2" I.D. PVC	9/27/95	13:40	9/27/95	13:45
Filter Placement:	9/27/95	13:45	9/27/95	14:30
Cementing:				
Development				
Bentonite Grout				
Bentonite Seal	9/27/95	14:30	9/27/95	14:45

Well Design & Specifications

Basis: Geologic Log X Geophysical Log

Casing string(s): C = Casing S = Screen

Depth			String(s)	Elevation		
+ 2.31	-	17.10	C1	453.71	-	434.30
17.10	-	26.90	S1	434.30	-	424.50
26.90	-	27.20	C2	424.50	-	424.20
	-				-	
	-				-	
	-				-	

Casing: C1 2" dia. Schedule 80 PVC, flush threaded with O-rings

C2 2" dia. threaded PVC end cap (4" long or 0.33')

Screen: S1 2" dia. Schedule 80 PVC, 0.010" machine cut slot, flush threaded with O-rings

Sand Pack: 16-35 mesh Silica Sand 12.8-28.0'

Filter Pack: 100 mesh Silica Sand 11.5-12.8'

Grout Seal:

Bentonite Seal: Extra high yield Wyo-Ben (100%) Slurry 3.0-11.5'

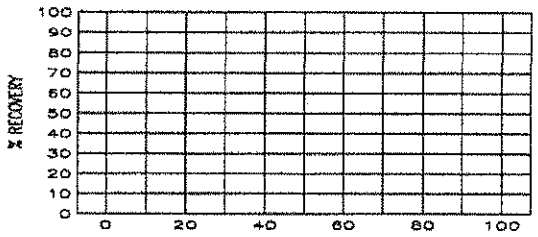
Concrete: 0.0-3.0'

Well Development

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (°C)

Recovery Data:



Comments:

Supervised by B. Harrington

Job Number 943-2848

Site LAIDLAW/OU2 RI-FS/MO

File Name PZ304AS

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED
REF. NO. 145102	
C.R. NO.	CHECK NO.
STATE WELL NUMBER	TRANSMITTAL NO.
CHECKED BY	ROUTE
APPROVED BY	ENTERED Ph 1 Ph 2 Ph 3

INFORMATION SUPPLIED BY MONITORING WELL CONTRACTOR

SITE/FACILITY NAME: LAIDLAW BRIDGETON SANITARY LANDFILL
WELL NUMBER: PZ-304AS
SITE ADDRESS: ST. CHARLES ROCK RD
CITY: BRIDGETON
STATE: Mo
ZIP CODE: 63044
OWNER NAME: LAIDLAW WASTE SYSTEMS, INC.
TELEPHONE: 314-241-3710
OWNER ADDRESS: 1936 N. BROADWAY
CITY: ST. LOUIS
STATE: Mo
ZIP CODE: 63102

VARIANCE ISSUED: ☐ YES ☒ NO
DATE ISSUED:
VARIANCE NUMBER: V

DESCRIBE LOCATION OF THE WELL SO WE WOULD BE ABLE TO VISIT IT
AT WEST FENCE LINE, 740' NORTH OF SOUTHWEST FENCE CORNER

LOCATION OF WELL
SHOW LOCATION IN SECTION PLAT
COUNTY: ST. LOUIS
SURFACE ELEVATION: 451.4
SMALLEST ¼ ____ ¼ ____ ¼ LARGEST ¼ ____ ¼
SEC. ____ TWN. 47 N,RNG. 5 E OR W
LAT. 38° 46' 01" LONG. 90° 26' 58"

MONITORING WELL INSTALLATION CONTRACTOR'S NAME: LAYNE WESTERN CO., INC.
PERMIT NUMBER: 0012588 WPM
DRILLING CONTRACTOR'S NAME: LAYNE WESTERN CO., INC.
PERMIT NUMBER: 0012588 WPM

WELL CONSTRUCTION INFORMATION

TYPE OF WELL: ☐ MONITORING WELL ☒ PIEZOMETER ☐ OTHER
TYPE OF POTENTIAL SITE: ☐ HAZARDOUS MATERIAL ☒ LANDFILL ☐ OTHER ☐ L.U.S.T.
MONITORING FOR: (CHECK ALL THAT APPLY) ☒ V.O.C. ☐ METALS ☐ PETROLEUM PRODUCT ☐ OTHER ONLY

PROTECTIVE CASING DETAILS (IF USED): LENGTH 5 FT. | DIAMETER OF CASING 8x5 IN. | WEIGHT OR SDR # 0.188" | DIAMETER AND DEPTH OF DRILL HOLE 8¼ IN. 28 FT. | JOINTS ☐ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER | MATERIAL ☐ THERMO PLASTIC ☒ STEEL ☐ FLUORO POLYMER TYPE | LOCKING CAP? ☒ YES ☐ NO

CAP VENTED ☒ YES ☐ NO
WEEP HOLE? ☒ YES ☐ NO
CASING GROUT DETAILS: MATERIAL ☐ CEMENT ☒ CONCRETE ☐ OTHER
DEPTH FROM THE SURFACE TO THE BOTTOM OF THE CASING GROUT SEAL: 3.0 FT.
TYPE OF SURFACE COMPLETION: ☒ ABOVE GROUND ☐ FLUSH MOUNT
DESCRIBE HOW THE FLUSH MOUNT WAS CONSTRUCTED

CENTRALIZER USED ON RISER: ☒ NO ☐ YES LOCATED AT
MATERIAL: ☐ STAINLESS STEEL ☐ OTHER

RISER PIPE DETAILS: LENGTH 20.3 FT. | DIAMETER OF RISER PIPE 2 IN. | WEIGHT OR SDR # SCH 80 | DIAMETER OF DRILL HOLE 8¼ IN. | JOINTS ☒ THREADED ☐ MECHANICAL ☐ WELDED ☐ OTHER | MATERIAL ☒ THERMO PLASTIC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER

ANNULAR SEAL: ☐ CEMENT SLURRY ☒ BENTONITE SLURRY ☐ NON SLURRY BENTONITE ☐ CEMENT/BENTONITE SLURRY
TYPE:
BAGS OF CEMENT USED
% BENTONITE USED
WATER USED/BAG GAL.

BENTONITE SEAL: MATERIAL BENTONITE ☒ SLURRY ☒ CHIPS ☐ GRANULAR ☐ PELLETS | LENGTH OF SEAL 8.5 | BENTONITE SEAL INSTALLED IN ☒ UNSATURATED ZONE ☐ SATURATED ZONE

	TYPE	GRAIN SIZE	LENGTH OF FILTER PACK	METHOD OF INSTALLATION	Information in this column to be supplied in the Feet from Surface column	FEET FROM SURFACE	FORMATION DESCRIPTION
PRIMARY FILTER PACK	☒ SAND ☐ MANUFACTURED ☐ NATURAL	16-35	15.2 FT.	H.S.A. POUR			
SECONDARY FILTER PACK	☒ SAND ☐ MANUFACTURED ☐ NONE	100	1.3 FT.	H.S.A. POUR	Depth to bottom of Protective Casing Seal:	3.0	0-13 Silt
WELL SCREEN	LENGTH OF SCREEN 10 FT.	DIAMETER 2 IN.	SLOT SIZE 10	WEIGHT OR SDR # SCH80	MATERIAL ☒ PLASTIC ☐ STEEL ☐ FLUORO POLYMER	Depth to Base of Annular Seal:	11.5	
SUMP DETAILS	LENGTH OF SUMP	DIAMETER OF SUMP	MATERIAL ☐ PVC ☐ STEEL ☐ FLUORO POLYMER ☐ OTHER			Depth to Base of Bentonite Seal:	11.5	
BACK FILL	WAS THE WELL BACK FILLED? ☐ YES ☒ NO	MATERIAL USED	LENGTH OF BACK FILLED BORE HOLE			Depth to Top of Primary Filter Pack:	12.8	
						Depth to Top of the Screen:	18.0	13-28 Sand
						Depth to Bottom of the Screen:	28.0	
						Total Depth:	28.0	

STATIC WATER LEVEL FEET FROM MEASURING POINT:
DATE OF STATIC WATER LEVEL:
MEASURING POINT FOR STATIC WATER LEVEL IS ☒ TOP OF RISER PIPE ☐ OTHER
ELEVATION OF MEASURING POINT: 453.71
MULTIPLE CASED WELLS: SUBMIT ADDITIONAL AS BUILT DIAGRAM SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE AND SIZE OF ALL CASING, HOLE DIAMETERS, AND GROUT USED.
DRILLING EQUIPMENT: ☐ AIR ROTARY ☒ AUGER TYPE 4¼ H.S.A. ☐ REVERSE ROTARY ☐ OTHER
DATE WELL DRILLING WAS COMPLETED: 9-27-95

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH THE DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS.

SIGNATURE PRIMARY CONTRACTOR/PERMIT #	DATE	SIGNATURE DRILLER/PERMIT #	DATE
Thomas H. Mahurin II.	11-15-95	Thomas H. Mahurin II.	11-15-95

MO 780-1415 (7-95)

DISTRIBUTION: WHITE/DIVISION CANARY/MONITORING WELL CONTRACTOR PINK/OWNER
MAIL WHITE COPY TO: DEPARTMENT OF NATURAL RESOURCES, P.O. BOX 250, ROLLA, MO 65402
ENCLOSE $35 PER MONITORING WELL FOR THE CERTIFICATION FEE WITHIN 60 DAYS AFTER WELL COMPLETION

RECYCLED PAPER

Drilling Log

Project Name: WESTLAKE							Boring No.: S-82
Project No.: 84-075-4-002							Page 1 of 2
Ground Elevation: 447.7	Location: NW Central Section of Site; Fig I-2						Total Footage: 26.5'
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. of Samples	No. Core Boxes	Depth To Water	Date Measured
SEE REMARKS	SEE REMARKS	26.5'	0	5	0	SEE REMARKS	-
Drilling Co.: WABASH DRILLING CO.					Driller (s): DORL THORNTON		
Drilling Rig.: ACKER MP-5, TRUCK					Type of Penetration Test: STANDARD		
Date: 8-24-84 To 8-27-84					Field Observer (s): GLEN ERNSTMANN		

Depth	Description	Class.	Blow Count	Recov.	Sample or Box No.	Remarks
1	BROWN SANDY CLAY, SOME GRAVEL, MEDIUM PLASTICITY, STIFF TO VERY STIFF, DAMP TO MOIST (FILL)					5" SOLID AUGERS 0' TO 20'.
2						
3						
4						
5					5.0	
6			5/4/8	14"/18"	SS-1	
7					6.5	
8						
9	BROWN FINE SANDY SILT, LOW TO NON-PLASTIC, STIFF, MOIST TO SATURATED					SATURATED MATERIAL ENCOUNTERED @ 11' TO 13'. UNSATURATED 13' TO 17',
10					10.0	
11			2/3/3	17"/18"	SS-2	
12					11.5	
13	LIGHT BROWN FINE TO MEDIUM SAND, DAMP					

TECHNICAL SERVICES
GEOTECHNICAL DEPARTMENT

Drilling Log (continued)

Boring No. S-82
Project Name WESTLAKE
Page 2 of 2
Project No. 84-075-4002
Date 8-27-84

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
15	LIGHT BROWN FINE TO MEDIUM SAND, DAMP				15.0		
	BROWN SILTY CLAY, MEDIUM PLASTICITY, VERY STIFF, MOIST		3/7/13	16"/18"		SS-3	
16					16.5		
17	BROWN-GRAY SILTY FINE TO MEDIUM SAND, MEDIUM DENSITY, SATURATED						SATURATED MATERIAL BELOW APPROX. 17' TO 18'.
18							
19							CASING WAS DRIVEN TO 20' & HOLE WAS WASH-BORED FROM 20' TO 25'.
20			4/7/12	15"/18"	20.0	SS-4	
21							STOPPED 8-24-84
					21.5		RESUMED 8-27-84
22							NOTE: HOLE HAS COLLAPSED TO 13.3' BELOW G.S. OVER THE WEEKEND.
23	GRAY-BROWN COARSE SAND, SOME FINE TO MEDIUM SAND, MEDIUM DENSITY, SATURATED						
24	PRIMARILY QUARTZ, SOME CHERT FRAGMENTS AND MAFIC MINERALS						
25					25.0		A 2" dia. PVC piezometer was installed to 25.5' PVC is flush-jointed, threaded couplings.
			7/14/29	17"/18"		SS-5a	
26	GRAY, SILTY FINE TO MED. SAND, SATURATED					SS-5b	
					26.5		Bottom 10' is .010" machine slotted screen.
27	TOTAL DEPTH 26.5'						Bottom 12.5' is gravel packed with a 2' thick bentonite pellet seal above.
28							Anulus is grouted from seal to surface.
29							T.O.P. is 3.0' above ground surface.
30							WATER LEVEL IS 18.2' BELOW T.O.P. IMMEDIATELY AFTER PIEZOMETER INSTALLATION 1:45 p.m. 8-27-84.

Barns & McDonnell
Engineers-Architects-Consultants

APPENDIX C

GEOLOGIC CROSS SECTION

NORTHWEST

B

SOUTHEAST

B'

Area 2 Limits

Inactive Sanitary Landfill

Transfer Station

Asphalt Plant

South Quarry Portion of the Bridgeton Landfill

Note: Projected Distance to the Cross Section (Typical)

BUFFER ZONE

D6 (52 ft from Southwest)
WL-202 (161 ft from Southwest)
S-61 (54 ft from Southwest)
MW-102 (129 ft from Southwest)
WL-211 (32 ft from Southwest)
WL-210 (82 ft from Southwest)
D-12 (64 ft from Northeast)
S-10 (45 ft from Northeast)
I-11 (35 ft from Northeast)
D-87 (82 ft from Northeast)
PZ-112-AS (184 ft from Northeast)
PZ-111-SD (106 ft from Northeast)
PZ-111-KS (110 ft from Northeast)
MW-F1D (112 ft from Northeast)
PZ-110-SS
PZ-109-SS
LCS-1D (14 ft from Northeast)
LCS-3C (138 ft from Southwest)
PZ-104-SS (19 ft from Northeast)
PZ-104-SD (22 ft from Southwest)
PL
PL
PL
Property Boundary

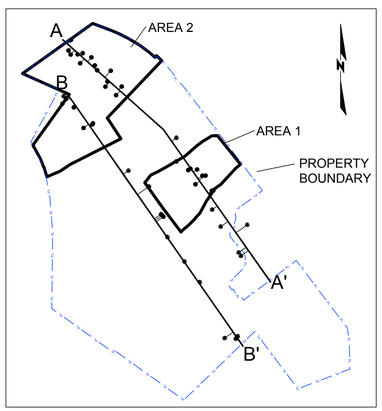
Solid Waste
Fill
Loess
Alluvium
St. Louis Fm
Salem Fm
Warsaw Fm
Keokuk Fm

430.12
429.99
429.97
430.12
430.42
430.18
429.73
430.06
430.50
430.75
463.89
431.35
461.52
456.45
463.90

ELEVATION ABOVE MEAN SEA LEVEL (feet)

450
400
350
300
250
200
150
100

NM



Cross Section Index

GEOLOGIC LEGEND

- Solid Waste
- Fill
- Loess
- Alluvium
- St Louis Fm Limestone
- Salem Fm Limestone
- Warsaw Fm
- Keokuk Fm Limestone

LEGEND

- Well Screen Interval
- September 2013 Alluvial Groundwater Elevation Taken at Well
- September 2013 St Louis Fm Groundwater Elevation Taken at Well
- September 2013 Alluvial Groundwater Elevation at Cross Section Intersection
- September 2013 St Louis Fm Groundwater Elevation at Cross Section Intersection
- September 2013 Potentiometric Contours
- Inferred Hydraulic Gradient within the Bedrock Unit
- Inferred Groundwater Flow Direction within the Alluvium
- Max/Min Alluvial Groundwater Elevation at Cross Section Intersection (July 2012 Through September 2013)
- Max/Min St Louis FM Groundwater Elevation at Cross Section Intersection (July 2012 Through September 2013)

Notes: These cross-sections were developed to display groundwater conditions beneath the site.
Please see the cross-sections in Appendix M for detailed portrayals of the RIM occurrences in Areas 1 and 2.
Ground surface from Aerial Topography provided by Cooper Aerial Surveys Co. and is dated December 2, 2016

0 75 150

HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION 5X

Figure 5-14

Cross Section B-B'

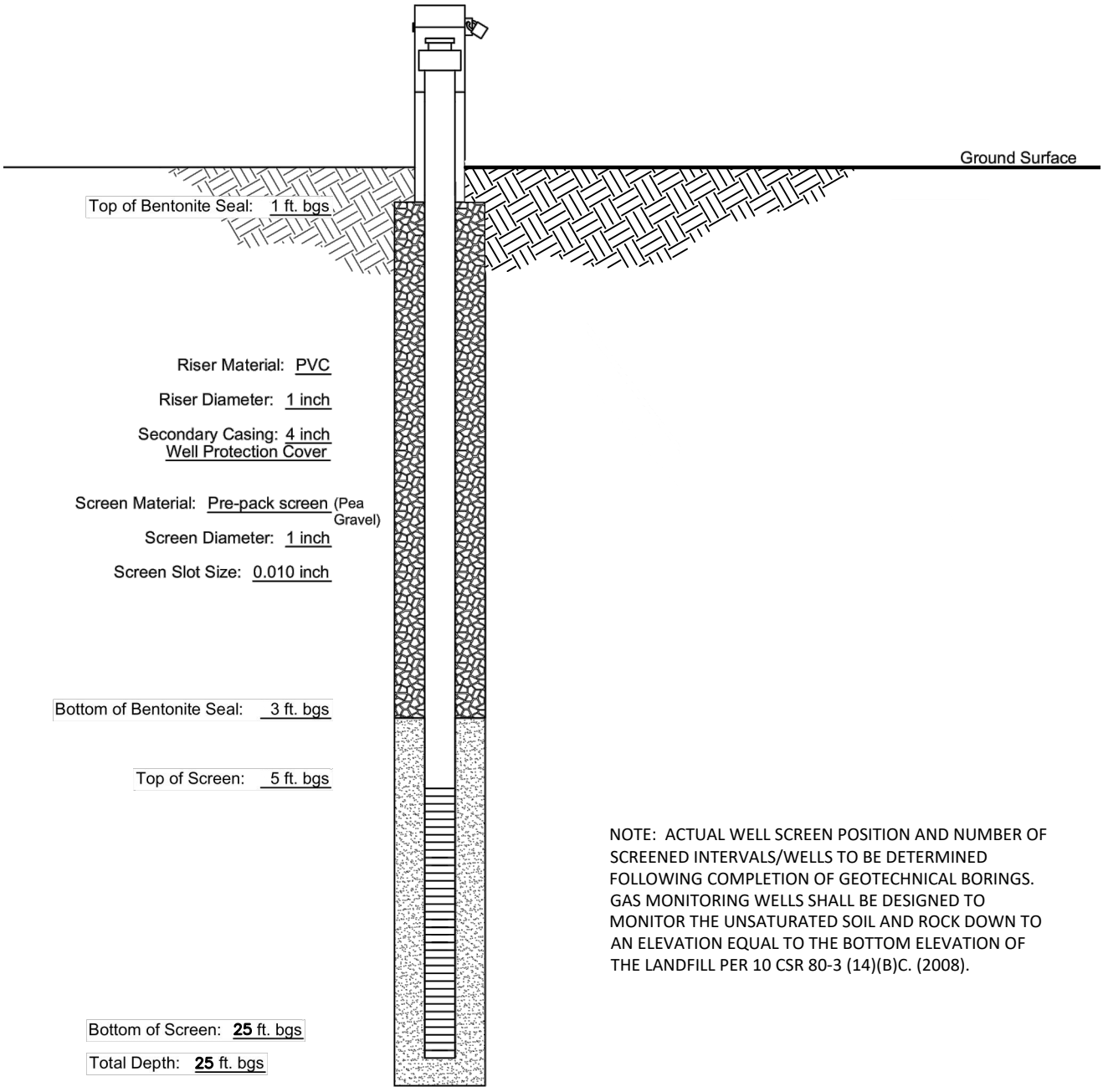
West Lake Landfill OU-1 RI Addendum

EMSI Engineering Management Support, Inc.

M:\clients\EMSI\westlake\2017\RI-Addendum-edits\Section-5\Fig-5-13_5-14-Xsections.dwg 1/22/18

APPENDIX D

PERMANENT MONITOR INSTALLATION SPECIFICATIONS



NOTE: ACTUAL WELL SCREEN POSITION AND NUMBER OF SCREENED INTERVALS/WELLS TO BE DETERMINED FOLLOWING COMPLETION OF GEOTECHNICAL BORINGS. GAS MONITORING WELLS SHALL BE DESIGNED TO MONITOR THE UNSATURATED SOIL AND ROCK DOWN TO AN ELEVATION EQUAL TO THE BOTTOM ELEVATION OF THE LANDFILL PER 10 CSR 80-3 (14)(B)C. (2008).

(Not to Scale)

***HAND SIGNATURE ON FILE**

Civil & Environmental Consultants, Inc.
4848 Park 370 Blvd., Suite F - Hazelwood, MO 63042
314-656-4566 · 866-250-3679
www.cecinc.com

INACTIVE SANITARY LANDFILL EXPLOSIVE GAS MONITORING PLAN

TYPICAL GAS WELL CONSTRUCTION

DRAWN BY:	CAN	CHECKED BY:	RFB	APPROVED BY:	TDM*	FIGURE NO.:	3
DATE:	MAY 2020	DWG SCALE:	N.T.S.	PROJECT NO:	191-750		

GAS MONITORING WELL CONSTRUCTION SPECIFICATIONS

1.0 DRILLING

1.1 Nominal Boring Diameter

In all cases where the diameter of the well pipe will be 1.0 inches, the minimum nominal borehole diameter of borings advanced through soil materials will be 5.0 inches in order to help ensure that the minimum width of the annulus around the well pipe will be 2 inches.

1.2 Drilling Methods

Borings should be advanced with drilling technology appropriate for the subsurface conditions at the site. Drilling methods shall facilitate extraction of drill cores for physical examination and classification of soils relative to gas transmission potential.

1.3 Cuttings

Drilling will be performed in a manner that minimizes the spreading of soil cuttings. Disposition of cuttings upon project completion will be the responsibility of Owner/Operator or the Owner/Operator's designated representative. Cuttings will be disposed of in accordance with applicable site and or local regulatory requirements.

2.0 SOIL SAMPLING

2.1 Drill Cores

During borehole drilling, the driller will attempt to retrieve continuous drill cores for physical observation. If any drilling interval is interrupted and a continuous core not retrieved, such intervals shall be noted in drilling logs including interpretation of probable stratigraphy based on core samples above and below the interrupted interval.

2.2 Sample Disposition

Disposition of sample material upon completion of the project will be the responsibility of the Owner/Operator or the Owner/Operator's designated representative.

3.0 GAS WELL CONSTRUCTION

3.1 Gas Well Pipe and Screen

Each monitoring well will be constructed of pre-cleaned Schedule 40 PVC pipe having an inner diameter of 1.0 inches (minimum). The use of threaded joints is recommended for all installation. The base of each well will terminate with a screen 10 feet in length unless otherwise required by project specifications. Screens will be factory-slotted. Slots will be 0.01 inch in width (maximum).

All personnel handling well materials will wear clean nitrile gloves and shall utilize appropriate decontamination procedures between drilling locations. All drilling equipment and materials shall be maintained in a clean manner.

Use of PVC pipe cutters is recommended whenever necessary to shorten sections of the PVC well pipe. Use of hacksaws or similar cutting implements is not recommended.

3.3 Sand Pack

Filter sand will be a clean sand of proper size in relation to the screen slots to prevent its passage into the well, with no fraction coarser than 0.25-inch nominal diameter.

Filter sand will be placed in the annulus around the well riser and to a point approximately 2 feet above the top of the screen. A tremie pipe shall be used whenever feasible for sand placement in excess of 10 feet.

3.4 Bentonite Seal

The annulus around the well pipe will be sealed with a layer of bentonite pellets, to be placed directly above the sand filter pack. The minimum thickness of the bentonite layer will be approximately 2 feet. The bentonite pellets should ideally be allowed 24 hours for hydration prior to continuing with well construction. A tremie pipe will be used where feasible for seal depths in excess of 10 feet.

3.5 Grout

Following hydration of the bentonite seal, each boring will be sealed with a Portland Type I bentonite/cement slurry, using the tremie pipe method or a bentonite slurry grout if required by the project.

Bentonite content in the cement slurry will be 2 to 5 percent by weight to help reduce shrinkage.

3.6 Surface Completion

All wells shall be completed as stick-up installation including use of a locking protective casing and concrete apron. The PVC riser will be provided with a slip type end cap. The end cap shall be fitted with a threaded stainless steel ¼ inch quick connect type fitting. The PVC riser (well pipe) will extend to an approximate height of 1.75 feet above the top of the concrete pad.

An outer locking protective casing shall be mounted within the concrete apron leaving approximately 2 inches of clearance to the top if the PVC riser. The driller will provide a lock for each protective casing. All locks will be keyed identically and all keys relinquished to the owner.

The apron will be constructed in such a manner that surface water will not return to it. The concrete apron will have the following minimum dimensions: 3 feet x 3 feet x 3.5 inches, and will be centered with respects to the riser and protective casing. A form will be used in constructing the apron. The upper surface of the apron will be graded to provide drainage away from the PVC riser.

A spike will be set into the pad for surveying purposes.

The outer protective casing will be constructed of steel pipe having a diameter, or diagonal, of not less than 8 inches. A drain hole having a diameter of 0.5-inch will be drilled through the outer protective casing near the top of the concrete apron. Shavings generated by drilling the steel casing will be prevented from falling into the well. The casing will be marked for surveying purposes.

4.0 SURVEYING

A licensed surveyor will survey each gas well elevation. Survey point(s) will include:

- concrete pad (marked with a spike) within $\pm$ 0.01 foot;
- outer protective steel casing, when open (engraved mark);
- inner PVC well pipe (engraved mark) within $\pm$ 0.01 foot;
- ground surface (not marked);
- well location to within $\pm$ 0.5 foot in horizontal plane; and,
- ground surface elevation to within $\pm$ 0.1 foot.

5.0 WELL DEVELOPMENT AND INSPECTION

Not required unless dictated by specific site conditions.

6.0 ANCILLARY REQUIREMENTS

6.1 Extraneous Material

The driller will take all reasonable care to ensure that each boring is free from all materials other than those required for well construction. Materials required for well construction is here defined to include polyvinyl chloride (PVC), sand, bentonite, Portland cement and natural soil materials. All other materials accidentally or purposely placed in the hole will be removed by driller prior to well completion.

6.2 Decontamination

All drilling equipment (drill steel, bits, casing materials) and any additional equipment, that contacts subsurface formations may be decontaminated prior to on site use, between consecutive on site uses, and/or between consecutive well installations, as directed by Owner/Operator or Owner/Operator's designated representative.

Appropriate decontamination procedure will consist of steam cleaning with potable water and biodegradable detergent (e.g., Alconox) approved by Owner/Operator or Owner/Operator's designated representative. Steam cleaning will be conducted in a manner that minimizes over-spray and runoff.

6.3 Disposition of Waste Water

If drilling fluids are used or monitoring wells constructed in an area of suspected contamination, well development wastewater will be placed in 55-gallon drums at the well site and subsequently disposed by the Owner/Operator.

6.4 Site Safety Plan

The driller is responsible for maintaining the personal safety of his employees while on site. The driller shall provide a copy of the project safety plan for review by the Owner/Operator no less than 7 days prior to commencement of field work.

6.5 Cleanup

The driller will be responsible for removing all refuse from each well site. Such refuse typically includes, but is not limited to, PVC pipe wrappers, sand bags, bentonite bags, cement bags, beverage containers, food wrappers and other forms of litter. Smoking on site will not be permitted.

GAS MONITORING WELL CONSTRUCTION SPECIFICATIONS

The driller will be responsible for providing the following information to the Owner/Operator's designated representative after well installation has been performed:

- date and time of construction;
- drilling method and fluid used (if applicable);
- boring diameter;
- well pipe (inner casing) specifications;
- well depth (+/-0.01 ft.);
- drilling/lithologic logs;
- specifications for other casing materials (if applicable);
- screen specifications;
- well pipe/screen joint type;
- filter pack specifications (material, size);
- filter pack volume and calculations;
- filter pack placement methods;
- bentonite seal specifications;
- bentonite seal volume;
- bentonite seal placement method;
- grout specifications;
- grout volume;
- grout placement method;
- surface completion specifications; and,
- well development procedure.

7.0 WELL CONSTRUCTION AND SOIL BORING LOGS

Certified copies of well construction and soil boring logs will be forwarded to the MDNR by the driller in accordance will applicable requirements following completion of well construction activities.